ANNUAL REPORT

OF THE

Association of Dominion Land Surveyors

Tenth Annual Meeting

HELD AT

OTTAWA

ON THE 31st JANUARY, 1st AND 2nd FEBRUARY, 1917

OTTAWA:
R. J. TAYLOR, PRINTER, QUEEN STREET.

1917

ROLL OF HONOUR

DOMINION LAND SURVEYORS

WHO HAVE ENLISTED FOR

OVERSEAS SERVICE

1914-17

HONOR ROLL

Alport, F
Baird, W J
Ball, A. N.
Barton, H M
Barwell, C. S. W
Beatty, F. W
Beresford, H. E.
*Bolton, L. E. S.
Bowman, E. P
*Bowman, H. J
Britton, G. C.
Browne, E. F
Burwash, N A
Bush, C. E.
Campbell, A. J
Cannell, H. W
Carroll, J.
Carscallen, H. R.
Carthew, J. T.
*Carthew, W. M.
Child, C.
Clarke, F. F.
Clark, R. F.
Clouston, N. S.
Cokely, L. S.
Cond, F. T. P.
Coursier, E. C.
Cumming, A. L.
*Dann, E. M.
Davidson, R. D.
Dawson, F. J.
Dillabough, J. B
Donnelly, C. B.
Draper, W. H.
*Earle, W. S.
Ellis, D. S.
†Elliot, G. R.
Ferguson, G. H.
Fletcher, J. A.
Fletcher, W. A.
Garner, A. C.
*Gass, L. H.
Gordon, M. L.
†*Graham, J. R.
Greene, P. W
Greene, G. E. D
Grover, G. A.
Haggen, R. W
Harper, C. J
Harvey, C.
Heathcott, R. V
Hobbs, W. E.
*Holcroft, H. S.
Hotchkiss, C P
Hunt, S.
Inkster, O
Johnson, A. W
Keeping, K.
Knight, S.
Lang, J. L.
Latornell, A. J
Laurie, R. C.
Logan, R. A.
Malcolm, W. L
†Meikle, A. U.
Melhuish, P.
Menzies, J. W
Moran, P. J.
Murdie, W. C.
*MacLeod, D. D
‡MacLeod, G. W.
MacKay, E. G.
MacPherson, A. J
MacTavish, W. H
McArthur, A. S.
McCallum, G. H.
McCloskey, M.D.
‡McDonald, H. F
McIntosh, J. S.
McKnight, J. H.
McLellan, R. A.
Neelands, R. A.
Nelles, D. H.
Nesham, E. W
Palmer, P. E.
‡Parsons, J L. R.
Parry, H.
Pearson, H E.
Perry, A. M.
*Pierce, B. C
†Pinder, G. Z.
Pounder, J.
Riddle, J M.
Robertson, D. F
Rolfson, O.
Roy, J. E.
Saunders, B. J.
Scott, W. A
Segre, B. H.
Seibert, F. V.
Sharpe, G. P.
Sheppard, A. C. T
Shaw, C. A E
Sibbett, W. A
Smith, D A
Smith, L. R.
Steers, F. P.
Stewart, A. G.
Stewart, L. D. N.
Stitt, O. M.
†Stock, J. J.
Swannell, F. C.
Tate, H. W.
Taylor, W. E.
Tremblay, A. J.
Van Nostrand, A.
Vicars, J. R. O.
Vickers, T N.
Waddell, W. H.
Wadlin, L. N.
Waugh, B. W.
Whyte, H. E.
White-Fraser, G.
†Wilkin, F. A.
Wood, N. C.

*Died on Active Service. †Military Cross. ‡D.S.O.

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OTTO KLOTZ, LL.D., D.Sc., D.T.S., &c.
Hon. President

OTTO KLOTZ, LL.D., D.Sc., D.T.S., &c.

Dr. Klotz was born at Preston, Ont., March 31st, 1852. Attended Dr. Tassie's Grammar School, Galt. Matriculated 1869 at University of Toronto in Art and Medicine, obtaining $120 scholarship in latter. Graduated from University of Michigan as C.E. in 1872. In Northwest in 1875; obtained D.L.S. and D.T.S. in 1877; continuously n Government service since 1879. Contract, Outline and Base Line work. Exploratory survey, 2,000 miles in a canoe, in 1884 to Hudson's Bay. In 1885 inaugurated the astronomic work of the Department, continued ever since, by the determination of longitude and latitude for the Railway Belt in British Columbia. Many of the peaks between summit of Rocky Mountains and Revelstoke named by him in 1886 in connection with accurate azimuth survey of C. P. R. In 1889 in Alaska. In 1892 on Trans-Atlantic longitude, connecting with Greenwich. In 1893 and 1894 in Alaska, Boundary Survey. In 1898 in London, Paris and St. Petersburg on special mission. In 1903-1904 in charge of Trans-Pacific longitudes, wiring the British Empire together astronomically, and completing first astronomic girdle of the world. Delegate for Canada at the International Seismological Association, at The Hague, 1907, at Zermatt 1909, at Manchester 1911, at St. Petersburg (Petrograd) 1914.

He was President of D. L. S. Association, 1882-1886; Ottawa Literary and Scientific Society, 1896-1899; Toronto University Club, 1897; O. L. S. Association, 1906-07; Carnegie Library, 1908-1910; Astronomical Society, Ottawa, 1908-1910; Canadian Club, 1912-1913; University Club of Ottawa, 1914-1915; and is Honorary President, D.L.S. Association, 1917.

The University of Toronto conferred the degree of LL.D. in 1904; The University of Michigan, D.Sc., in 1913; and the University of Pittsburgh, LL.D., in 1916.

He is a Fellow of the Royal Astronomical Society of England; ditto of Canada; Fellow of the Royal Society, Canada; Fellow of the Amer. Association Advance Science; Fellow Amer. Geographical Society; Honorary Member New Zealand Institute; Member Author's Club, London; Member of the Astronomical Societies of France, Mexico and Germany; Member of the Washington Academy of Science; and of the Seismological Society of America. He has published many papers on Astronomy, Terrestrial Magnetism, Gravity and Seismology. Clubs: Rideau, Rivermead, University.

J. J. McARTHUR, D.L.S.,
President

J. J. McARTHUR, D.L.S.

James Joseph McArthur, born at Aylmer, Quebec, in 1856. Educated at the Aylmer Academies and by private tution. Went to Manitoba as a member of a Survey party in 1872, and has been connected with Surveys, carried on by the Department of Interior ever since. Commissioned in 1879, and was engaged on Subdivision, Meridan and Base line work until 1886, when started the Photo-topographic Survey of the Rocky Mountains under the direction of Capt. Deville, Surveyor General. In 1893 was detailed to the Staff of Her Majesty's Commissioner, W. F. King, to make surveys preliminary to the settlement of the Alaska Boundary question. Spent the years 1897, 1898, 1899, 1900 and 1902, exploring in the Yukon. In 1899 was attached to the High Joint Commission setting at Washington, D. C., as Geographer. In 1903, was attached to Staff of the British Agent before the Alaska Boundary Tribunal at London, England.

In 1904 commenced the final demarkation of the Boundary along the 49th Parallel from the Pacific Ocean to Lake of the Woods. In 1909 was appointed Assistant International Boundary Commissioner. In 1916, completed the Canadian sections of the Boundary from the Pacific to Lake Superior. Was appointed His Majesty's International Boundary Commissioner to succeed the late Dr. King. 1917, elected President of the D.L.S. Association and President of the Ottawa branch of the Royal Astronomical Society.

Association of Dominion Land Surveyors.

OFFICERS FOR 1917-1918.

Patron:

E. Deville, I.S.O., LL.D., D.T.S., Surveyor-General.

Honorary-President:

Otto Klotz, LL.D., D.Sc., D.T.S., Etc.

President:

J. J. McArthur, D.L.S.,
International Boundary Commissioner.

Vice-President:

T. Shanks, D.L.S.,
Assistant Surveyor-General.

Second Vice-Presidents:

G. H. Watt, D.L.S., Ontario.
J. E. Sirois, D.L.S., Quebec.
G. A. Bayne, D.L.S., Manitoba.
J. E. Morrier, D.L.S., Saskatchewan.
R. W. Cautley, D.L.S., Alberta.
N. C. Stewart, D.L.S., British Columbia.
H. G. Dickson, D.L.S., Yukon.

Executive Committee:

E. M. Dennis, D.L.S. J. L. Rannie, D.T.S.
H. L. Seymour, D.L.S.

Secretary-Treasurer:

E. W. Hubbell, D.L.S.

CONSTITUTION

ARTICLE I.

Name of the Association.

"The Association of Dominion Land Surveyors."

ARTICLE II.

Objects of the Association.

The promotion of the general interests and the elevation of the standard of the profession.

ARTICLE III.

Members.

1. The Association shall consist of Active Members and Honorary Members.

2. Active members must be Dominion Land Surveyors, and only such shall hold office.

3. Any Dominion Land Surveyor may become an Active Member upon payment of the fees prescribed by Article IX.

4. Honorary Members must be nominated by two Active Members, and the nomination approved of by a unanimous vote of the Executive Committee. The nomination, with approval, must be in the hands of the Secretary-Treasurer at least one month before the Annual Meeting. They shall be elected by ballot in the manner hereinafter provided for the election of officers of the Association. The number of Honorary Members shall not, at any one time, exceed ten, and they shall be exempt from payment of dues.

5. As a member arrives at the age which makes him the oldest man in the Association, he will automatically become an Honorary Member.

ARTICLE IV.

1. The Surveyor-General of Dominion Lands shall be Patron of the Association.

2. The officers of the Association shall consist of an Honorary President, a President, a Vice-President, a 2nd Vice-President from each Province, a Secretary-Treasurer, and an Executive Committee, all of whom shall be nominated at the General Annual Meeting,

excepting the 2nd Vice-Presidents for the Provinces, whom shall be elected separately by each Province. The ballots to be sent members by the Secretary-Treasurer.

3. Voting for officers shall be by letter ballot, which ballot will be issued by the Secretary-Treasurer to all members immediately after the Annual Meeting each year.

4. The ballots are to be returned to the Secretary-Treasurer on or before the 20th day of March, in each year, to be opened and counted by him.

5. Candidates and retiring officers are to be notified by the Secretary-Treasurer of the result of the election.

6. The Secretary-Treasurer is to have a vote only in the case of a tie.

ARTICLE V.

Meetings.

1. The Annual General Meeting shall commence on the last Wednesday in January, at Ottawa.

2. Special meetings of the Association may be called by the President, or by the President when requested in writing by three or more members.

3 Nine members shall form a quorum at any meeting for the transaction of business.

ARTICLE VI.

Any member of the Association who may desire a change in the Constitution of the Association, shall give notice of such contemplated change to the Secretary-Treasurer, at least one month before the next Annual Meeting, and the Secretary-Treasurer shall, in his notice of such meeting to the members, notify them of the name of the party proposing such change, and the nature thereof.

No by-law or rule shall be altered, or new one adopted, except at a General Meeting, and such amendment shall be voted upon at the said General Meeting, two-thirds majority of the votes cast being necessary for its adoption.

ARTICLE VII.

Executive Committee.

1. The Executive Committee shall consist of the President, Vice-President, Secretary-Treasurer, and three members, and shall have the direction and management of the affairs of the Association. Three members shall form a quorum.

2. The meetings of the Executive Committee to be held at the call of the President or Secretary-Treasurer.

ARTICLE VIII.

AUDITORS.

Two Auditors, to be elected by ballot, shall audit the accounts of the Association annually, and present their report of the same at the Annual General Meeting.

ARTICLE IX.

SUBSCRIPTIONS.

1. The fee for membership for Active Members shall be two dollars, payable in advance.

2. The fees of Active Members shall be forwarded to the Secretary-Treasurer with the ballot paper for election of officers, and any ballot unaccompanied by the fees mentioned in sub-clause No. 1, in case the said fee has not previously been paid, shall not be counted in the election.

BY-LAWS

ORDER OF BUSINESS.

1. Reading of Minutes of previous meeting.
2. Reading of correspondence and accounts.
3. Nominations for Honorary Membership.
4. Balloting for Honorary Membership.
5. Reports.
6. Unfinished Business.
7. New Business.
8. Nomination of Officers.
9. Adjournment.

2. All motions must be in writing, and shall contain the names of the mover and seconder, and must be read by the Chair before being discussed.

3. Reports of Committees must be in writing, signed by the Chairman thereof.

4. No member shall speak on any subject more than once, except the introducer of the subject, who shall be entitled to reply; every member, however, shall have the right to explain himself, subject to the discretion of the Chair.

5. When a motion has been finally put to the meeting by the Chairman, all discussion thereon shall be closed.

6. The Chairman shall appoint two scrutineers when a ballot is taken.

7. Every member, while speaking, shall address the Chair.

8. Parliamentary Rules to govern in all cases not provided for in preceding sections.

Duties of Officers.

1. The President shall preside at all meetings at which he is present; in his absence, the Vice-President; and in the absence of both, the meeting shall appoint a Chairman.

2. The presiding officer shall only have a casting vote, not a deliberate one.

3. The Secretary-Treasurer shall keep an accurate record of all meetings, conduct all correspondence, announce all meetings, receive all fees and subscriptions and other moneys, pay no bills unless sanctioned by the Executive Committee and signed by their Chairman, make an annual report of all receipts and disbursements, and shall perform such other duties as may from time to time be assigned him by the Executive Committee.

Association of Dominion Land Surveyors.

TENTH ANNUAL MEETING.

OTTAWA, WEDNESDAY, JANUARY 31ST, 1917.

The Tenth Annual Meeting of the Association of Dominion Land Surveyors, opened this morning in the Carnegie Library. President, A. H. Hawkins, B.A.Sc., C.E., D.L.S., in the chair.

Members and their friends present at one or more of the sessions:—

Adams, Thos.
Akins, J. R.
Armstrong, W. B.
Bennett, G. A.
Blanchett, G. H.
Boulton, W. J.
Bradley, J. D.
Bray, R. P.
Brown, T. E.
Campbell, R. H.
Carroll, M. J.
Clunn, T. H. G.
Cochrane, M. F.
Cote, J. M.
Cowper, G. C.
Craig, J. D.
Cram, A. S.
Davies, T. A.
Dennis, E. M.
Dennis, M.
Dennis, T. C.
Dennis, J. S.
Deville, Dr. E.
Dodge, G. B.
Elder, A. J.
Engler, C.
Fawcett, T.
Fawcett, A.
Finnie, O. S.
Fletcher, J. A.
Hawkins, A. H.
Henderson, F. D.
Hubbell, E. W.
Jones, G. S.
Kitto, F. H.
King, J. A. S.
Klotz, Dr. Otto.
LeBlanc, P. M. H.
Lighthall, A.
Lonergan, G. J.
Magrath, C. A.
Mountain, G. A.
McArthur, J. J.
Macdonald, C. S.
McGarry, D. J.
McKnight, J. H.
McRae, A. D.
MacMillan, J. R.
McClennan, W. D.
MacCloskey, M. D.
MacIlquhan, W. L.
Nash, T. S.
Narraway, A. M.
Norrish, W. H.
Peaker, W. J.
Purcer, R. C.
Pierce, J. W.
Rainboth, G. L.
Rannie, J. L.
Rice, F. W.
Rinfret, C.
Roger, A.
Seymour, H. L.
Scott, W. A.
Shanks, T.
Stewart, A. D.
Symes, P. B.
Thomas, A. S.
Walker, C. M.
Watt, G. H.
Wilson, E. E. D.
White, Jas.
Wight, E. J.
and others.

The Chairman: Gentlemen, you will now come to order please. I think the time has arrived when we should wait no longer, but proceed with the business of our meeting. I will therefore call on the Secretary to read the minutes of our last meeting.

Secretary Hubbell: The minutes of the last Annual Meeting are embodied in the annual report, and if there is no objection, I move that they be approved as published.

Mr. McArhtur: I second that motion. Carried.

Correspondence.

Secretary Hubbell: There has been but little correspondence during the past two years on matters pertaining to the welfare of the Association. Our correspondence in general, consists of letters from members enclosing fees or asking for information, very few write on matters of importance in connection with the Association, between sessions. I have a letter, however, from Mr. S. Bray, D.L.S., which may be of interest. (Letter read).

The Chairman: Gentlemen, what is your pleasure in regard to this communication?

Secretary Hubbell: In discussing matters of this nature to-day with the President, I thought it might be a good suggestion if the oldest surveyor, a member of the Association, be elected an Honorary Member. As an example, Mr. Moses McFadden, who, I think, is ninety-one years of age, still pays his dues to the Association, although he has not done-survey work for a long time. If my suggestion meets with your approval, some member might submit a motion to that effect. We have also to fill the position made vacant by the unexpected and regrettable death of our beloved Honorary-President, Dr. W. F. King, C.M.G., D.T.S.

It will therefore be necessary for the members to decide as to who will be our next Honorary-President.

Regarding the suggestion presented by Mr. Bray in his letter, I may say, that we have a number of surveyors seventy years of age, (members of the Association) and that there is no provision in our Constitution for members such as Mr. Bray refers to, although the subject is worthy of discussion.

Mr. Chairman: We would like to hear any suggestions from the members of the Association.

Mr. McArthur: As to the making the oldest member of the Association an honorary member, I would like to make a motion to that effect.

Moved by Mr. McArthur, seconded by Mr. Lonergan, "That the By-Laws be so amended as to read 'That as a member arrives at the age which makes him the oldest man in the Association, that he will automatically become an honorary member.'" Carried.

A MEMBER: Would that mean one member each year?

SECRETARY HUBBELL: Oh no, the oldest surveyor only, a member of the Association.

THE CHAIRMAN: The next order of business, gentlemen, is the President's address, which is unfortunately my duty to have to present to you.

PRESIDENT'S ADDRESS.

GENTLEMEN:—

It is with feelings of mingled pleasure and sorrow that I welcome you, members and visitors, to our tenth annual meeting; pleasure in meeting so many old friends and companions, in such congenial surroundings, sorrow in that so many of our profession, obedient to the "call," hurried to the mother's side in her need, where, as was to have been expected, several have very greatly distinguished themselves, and no doubt that others will be heard from before *finis* is written, and some have made the supreme sacrifice, in her and our defence.

I trust that the matters brought before you may be considered in a thoughtful and careful manner, remembering at all times during our deliberations and discussions, the best interests of the profession, which we all have so much at heart.

Permit me first of all to thank the Association of Dominion Land Surveyors for the high honour they were good enough to bestow, by electing me to the presidency at the annual meeting in January, 1915, while I was absent, at work in the northern regions of Canada.

Your Executive Committee, after careful consideration, decided that no meeting of this Association should be held during 1916, with that decision I fully concurred, as it seemed, at that time, that the members were all so obsessed with war matters that it was deemed inadvisable to ask them to turn their attention to matters other than the War.

After similar consideration it was decided, that having regard to the requirements of Canada after the war, it would be the duty of this Association to meet at this time, for the purpose of considering and preparing for the solution of the many problems of National importance which an Association, as important as ours, both as to the individual and collectively, would be asked to lend their aid in solving. Hence this meeting was called.

It is with very great satisfaction and pride that we have to announce that some forty-one members of this Association have heard the call to arms, and have gone to the front, while others are preparing to go. Of those who have gone, four have laid down their lives in France or Flanders, not for Canada or Canadians alone, but for the sacred cause of freedom and liberty throughout the world; those priceless legacies handed to us by our forefathers which all British subjects conceive to be their duty to hand down, unfettered and unsullied, to generations yet unborn.

It is with sincere sorrow that we have to chronicle the death of our late lamented Honorary President, Dr. W. F. King. A man who was loved and revered by every member of the profession to whom he was known, whose uniform courtesy and good nature, coupled with that ripe scholarship, which he exerted at all times for the promotion of learning and the good of humanity, as well as the advancement of the profession of which he was a very brilliant member. We cannot but feel that this Association has sustained a most serious loss in the death of this kindly, learned and proficient Surveyor.

We also regret the loss by death of the following Dominion Land Surveyors:—Messrs. J. Brady and E. W. Robinson, since we last met, both of whom were men distinguished in their profession, and worthy members.

The surveys carried out by the Department are each year assuming a character of more importance. Greater accuracy is being aimed at, and the character of Monuments now placed in the field is of a greater permanence and stability. This is as it should be, as the work of the surveyor, if properly carried out, prevents later and costly disputes, and tends to a more contented and satisfied population when it is realized that the boundaries of their properties are fixed. Added to this, the Department is constantly receiving information of the greatest value to prospective settlers, and with the vast areas still fit for habitation, and only awaiting the ring of the woodman's axe, or the call of the plowman, before this great Canada shall attain and be able to take the place destined for her in the great Anglo Saxon family of nations, as a resplendant and sparkling jewel, firmly imbedded in the crown of the great and glorious British Empire.

The Land Surveyor has a great duty yet to perform in further preparing the way for the setting loose of vast forces, the ultimate attainment of which no one can foresee, but all of a benign, benevolent, beneficial and beneficient character to humanity, such as should ever be the object of the Civil Engineer, the result of the operations of which human agency, aided by mechanical appliances, all tending to the development and enrichment of millions of uncultivated acres in this Canada of ours. Will he be equal to the task when called upon by the National Power to perform it? Such a task as involves separation from family, loss of home comforts, privations, and hardships. I am sure, as in the past, the members of this Association will loyally rise as individuals to quickly perform any duty so imposed.

The War, with the enormous expenditure necessary to its successful prosecution, has had a somewhat deliterious effect on surveys in the past, but there are those who look for a vast immigration from Europe, of settlers who will desire to take up western lands. There are also our own soldier lads who, unfitted for their usual avocations, may desire to be placed upon the land. The situation thus likely to be created, may entail a duty upon the Government of undertaking new surveys to be ready to meet those conditions.

Some years since, it was suggested in the House of Commons that all such work should come under the general head of engineering, and be placed under the control of one Department with a Ministerial head, the various branches, of course, to be maintained as at present, but the whole to be co-ordinated, and in this way avoid a duplication of Public Works, which now frequently occurs, under the present system.

Young men would thus be trained by skilled officers in the various branches, and their training would be much better than that secured by the present haphazard methods. They would be specialists in their respective branches. Organization would lead to better methods and better work. This same idea would be extended to good roads and municipal drainage, giving to each of these important branches a character and standing at present wanting, and in the case of drainage, cutting off the enormously expensive lawsuits, and yet carrying out the absolutely necessary schemes for drains that the leveller portions of the country demand.

If the object lesson, presented so forcibly by the barbarous Prussian, and costing us so much in money and blood, is to be effective, surely organization should be the key note, not alone of the Dominion Land Surveyors, but of Engineers generally. "Men who do things," to them the people look to have organization instituted and carefully guided to a successful and much needed cohesion, with the object of concentrating and directing all efforts now under way to make this a better and more comfortable place in which to live.

In spite of the war, many great public works, such as the Hudson's Bay Railway and the Welland Canal, are being prosecuted, and since the last meeting of this Association, two new transcontinental lines of railway have been completed, but the war, most unfortunately, is causing the Managers of these lines, as well as the Government, many serious thoughts, and to some extent the completion of these works may be delayed.

Certain lines of business are suffering severely, but others are going ahead by leaps and bounds, notably the manufacture of munitions and all allied trades. Bankers, and men high in the financial world are urging on all classes to save and economize for the harder times yet ahead, and to help the Government to finance the enormous expenditures necessary to the carrying on of the war. Let me urge upon all members of this Association, to listen to these various calls to aid our country to carry on to a successful and victorious conclusion this gigantic struggle, for not alone our own country or our own National life, but for the good of the race as a whole and for the generations that in the coming years will rise up and bless those who so wholeheartedly and unselfishly gave of their substance to help in resisting the efforts of the fiendish Hun in their ambitions to subdue humanity, and place them under the heel of a Military Autocracy.

I should like to draw the attention of this Association to the composition of the Commission appointed during the last session of Parliament to make a physical valuation of Canadian railways, and to point out that no Canadian Engineer was placed thereon. One member stated in the House, "that there were no Canadian Engineers qualified for this very important work" This I beg to submit is a direct menace to the members of our organization, and I believe that it would be quite in order for this Association to appoint a small Committee to consider the matter in a careful and unbiased spirit, and present their conclusions to the Government, not as a hostile criticism, but in a friendly and patriotic manner, as I am firmly convinced that investigation would show that there are Canadian Engineers who stand second to none in the world, quite as capable of undertaking this work as those engaged, and whose code of ethics is so high, and firmly founded, that their decision would be as impartial, unbiased, and just as could possibly be asked for.

After all, the matter will have to be largly one of evidence and reports, as no Commission could possibly go over these various roads and from observations and surveys establish a valuation, without the evidence and reports given and compiled by other hands.

Should this matter go unnoticed, there is no reason why other branches of Engineering may not be similarly overlooked, and foreigners asked to take up work that is strictly Canadian. I feel that this Association should at least place on record their views on this very important matter.

It is with sincere pleasure that we are able to extend to our Patron, the Surveyor General, our hearty congratulations upon the timely and well merited recognition, by His Majesty King George, of his great abilities and scholarship, and also of the work that he is accomplishing in bringing Dominion Land Surveyors up to that high standard of excellence which has been attained. Imperial Honours, when bestowed in such well merited and deserving cases, give them a standing and cause them to be looked upon by our people with satisfaction and approval, when ability and merit are so rewarded.

I regret exceedingly that so many Dominion Land Surveyors have allowed their subscriptions to fall into arrears, as with the work that this Association may do for the welfare of Surveyors, both individually and as a body, I consider it would be a most serious concern to allow the Association to end through our neglect. We are comparatively a small body, and many of our members have gone to the front, and during their absence their standing is of course maintained by the Association, and when the Association is trying as best it may to help the comrades overseas, and under the excellent guidance of our efficient and vigilant Secretary, this is of very considerable value to those men who have so gallantly gone forward. When I say the Association is so placed, I submit it is the duty of every Dominion Land Surveyor to send in his subscription as a member, and help us when we need help, so that we may lend a hand to our brave companions.

The Executive and our efficient Secretary have arranged a most excellent programme, which I am sure will appeal to every member who is fortunate enough to be present at this our tenth annual meeting.

In conclusion, let me thank you all once more for the honour you have bestowed on me in electing me to the highest position within your gift. I desire to testify to the kind and able co-operation of our efficient Secretary-Treasurer, the Executive Committee, two of who have enlisted and gone overseas, and all our members, and finally to offer, not that the same may be necessary, for I do not believe that it is, this suggestion by way of a timely reminder which can do no harm, that this Association, and its individual members, impressed as they are with the magnitude of the task of the British Empire in the great struggle now pending for the sacred rights of freedom and iberty of the world, may all consecrate and devote their time, talents and substance to the consummation we all so earnestly desire in this; that out of the universal sacrifice made by the Empire and its allies, may issue an everlasting peace, to be secured for all time, so that it may hereafter be said, in the words of the old adage, "That a nation's word is as good as its bond."

Mr. McArthur: I beg to move that the President will leave the Chair and that Mr. Dennis will officiate.

Mr. McArthur: Gentlemen, I am sure that we all appreciate the address given by our worthy President. It is such an address as the times have brought forth. Our President speaks about our Association taking part in affairs, not altogether belonging to the Association. I, for one, thoroughly agree with him on this point. Surveyors generally leave for the field in the spring, come back in the winter and take no interest in anything but their returns, and for this reason we have greatly suffered. This country is being developed along many lines. Surveyors were the pioneers, the first and volunteer immigration agents, and the first to advocate the protection of game, and the conservation of our forests. The results of the work of land surveyors caused the creation of various branches of the public service and on which we are not represented. We have Lands Branches, we have Parks Branches, we have the Commission of Conservation, etc., and surveyors, who were the first to advocate the organization of those particular branches, and were peculiarly fitted for that kind of work, made no effort to secure positions on these staffs. If there is something doing, get in on it. We have been altogether too modest and too retiring. I suppose the example was given by the older members and the young members followed in their steps. We have the qualifications to do it. We have the prestige and we can do it.

The Chairman: You have heard Mr. McArthur's motion.

Mr. Seymour: I have much pleasure in seconding the vote of thanks to our President for his address. I think the words of Mr. McArthur are very wise and should be taken to heart by the younger members of the Association. Surveyors should broaden the scope of their work, they should extend the field of their activities and show everybody what they are capable of. I have much pleasure in again congratulating our President for his excellent address.

Vote of thanks carried.

Mr. Dennis: Mr. President, I beg to offer you the thanks of the Association, as moved by Mr. McArthur and seconded by Mr. Seymour.

Mr. Hawkins: If the small effort that I have made is helpful, I am very thankful. During the present times, there just seems to be one subject to which our mind reverts: that is the question of this war. Speaking to one of the officers in our locality, he made the following statement: "Every man that is of physical fitness has no excuse for not going to the front." Perhaps that is putting it very strongly, but I would like to point out this in connection with the war. I am not a pessimist, I think we will succeed but at the present time our armies in Flanders are practically where the Germans were stopped on their great rush on Paris. Our shipping is rapidly being destroyed. Is Great Britain going to be starved out? I hope not. The Russians have done wonderful work but they have been driven back. We hope the Allies will soon push back the Germans. But we have been told so many things that have not succeeded that one cannot help but be a little doubtful. But before this Association winds up its business, I should be very glad if there was some motion or action taken to be put on record showing that this Association, as a body, is willing to do anything which comes its way. In regard to Mr. McArthur's suggestion, I have no doubt but that the facts are true. We have a Commission of Conservation, we have Forestry Branches, etc., and there are very few surveyors on their staffs or who are taking part in this work. There are many young men coming up in our profession and I should like to see this Association branch out and point out the way to some of the younger members as they come along.

Mr. McArthur: I move, Mr. Chairman, that the President's address be adopted.

Secretary Hubbell: I would like to offer a few remarks in connection with the very able address of our worthy President. His address shows much forethought, study and deliberation and there are many good suggestions which should receive our careful consideration. At our annual meetings, members as a rule, after discussing points of interest, are apt to refer their suggestions to committees to be dealt with. From experience, I know, that committees of this nature seldom take further action, or in fact, meet together again during the year. I do not know whose duty it is to convene these committees, but the fact remains, that the members appointed do not act and the onous of the work is left for the Secretary., I am ready to act on any committee, at all times, but would appreciate advice and assistance of members of the Association; of what use are suggestions and motions if not followed up?

So much has happened in Canada during the past two years, that it is superfluous for me to take up your time by repeating what we are all conversant with. The President has pointed out our reasons for not meeting last year. I might add to his remarks that our annual reports are becoming more and more expensive, owing to the increased cost of material. Our revenue is gradually decreasing, for the following reasons:—the number of members enlisting for overseas (exempt from payment of fees); the number of members very much in arrears in their payment of fees, and the resignation of several members.

I wish to make it known that during the past two years, forty-three Dominion Land Surveyors, members of our Association, have answered the call of the Empire and have enlisted for overseas service. Many have gone as commissioned officers, others, I am proud to say, as privates. Several have won distinction on the field, while others have made the supreme sacrifice.

Several surveyors recently called on me with the object of obtaining commissions in the Artillery, in order to proceed overseas. In my opinion there is no class of men more suitable for overseas service than surveyors. The qualifications of the profession are most suitable for the basis of efficient soldiers and experience has shown that those who enlisted have made good and are an honour to the profession, comparing most favourably with other officers appointed by our Government.

During the Riel rebellion of 1885, an Intelligence Corps, comprised of surveyors, was organized by Mr. J. S. Dennis, D.T.S., and excellent work was performed by that corps. A similar organization might well have been formed for this great war; and I am positive that such an organization would have given excellent results.

Should any of our surveyors desire a commission in the Field Artillery, I am in a position to assist them and I promise you that I will do all in my power to further applications; but I cannot guarantee appointment to an overseas unit after they have qualified as officers.

I have great pleasure in seconding Mr. McArthur's motion. Carried.

The Chairman: Next we have the report of the Secretary-Treasurer. Has any gentleman any remarks to make in connection with what the Secretary has just said?

Mr. McArthur: Mr. Chairman, referring to the order conferred upon the Surveyor General, by His Majesty the King, I think it is to be regretted that the recommendation should not have been for C.M.G. instead of I.S.O. I think it should be a good idea perhaps to have a recommendation made to the Minister and to the Prime Minister, that a higher distinction be conferred upon the Surveyor General. I would like to move that a committee composed of Messrs. Dodge, Dennis and Rannie be appointed to deal with this matter.

Mr. Rannie: I personally think that somebody who has more weight with the Minister than myself would be a much more suitable man to act on this committee. I am sure that no representations of mine would have so much influence as those of Mr. McArthur. I would much prefer seeing Mr. McArthur on that committee than myself.

Mr. Dodge: I feel like Mr. Rannie, and would ask to have my name withdrawn for some older member.

Mr. McArthur: I don't think this is material, as long as they are representatives of the Association.

Mr. Dodge: I would like to see Mr. McArthur, Dr. Klotz and Mr. Shanks appointed.

Mr. Rannie: Mr. President, if you will allow me to speak again, I would like to present the following: that Mr. McArthur, Mr. Fawcett and Mr. Shanks be appointed on this committee.

Mr. Lonergan: Mr. Fawcett, Mr. McArthur and Mr. Shanks. I second this motion.

Secretary Hubbell: It is all very well to nominate these gentlemen, but as they are not present to agree to this proposition, I think we should leave it over until unfinished business is taken up, to-morrow afternoon.

A Member: There is one man that ought to be on that committee and that is Major Hubbell.

The Chairman: Is there any further dicussion, gentlemen? There are some matters which I have mentioned and which I would like to have considered in connection with the question raised by Mr. McArthur. We have not time to talk them over just now but they will all come up at our meeting to-morrow afternoon. I think it would be well if the gentlemen would make a note of anything of what I have said or what Mr. McArthur has said and we will have a discussion on any of those matters which interest us. We will now have the Secretary-Treasurer's report.

SECRETARY-TREASURER'S REPORT.

OTTAWA, JANUARY, 1917.

MR. CHAIRMAN:—

As Secretary-Treasurer of the Association of Dominion Land Surveyors, I have the honour to submit the following report of the business of the Association, transacted between the 28th January 1915 and the 31st January 1917. (Two years).

Arrangements were made with R. J. Taylor, Printer, Ottawa, for the publication of the annual report. After the minutes had been revised, together with reports and other miscellaneous papers collected, comprising the proceedings at the annual meeting, they were placed in the hands of Mr. Taylor for publication.

It was not, however, until the end of May, that the reports were completed and ready for distribution. Copies were then mailed without delay to all members of the Association in good standing, and also to members who were not more than three years in arrears with their annual dues. These reports were mailed to the last known address of the surveyor, on file in this office. In some cases the reports failed to reach their destination and were returned for better address; the same thing happened to other communications and circulars similarly addressed. If not notified, we have no way of keeping track of change of address.

Four hundred and fifty (450) copies of the report were printed at an average cost of sixty-seven cents per copy. This apparent high cost was due principally to the number of illustrations accompanying some of the lectures.

Exchange of reports was arranged between our Association and the Ontario and Alberta Surveyors' Associations and a few additional copies distributed as follows:—

Ontario Land Surveyors' Association, exchange......	150 copies
Alberta " " " "	10 "
Advertisers, free..................................	4 "
Complimentary (Universities, Libraries, etc.)........	40 "
Members of the Association D. L. Surveyors'........	231 "
On hand..	15 "
Total......................	450 copies

The reports of the Ontario Land Surveyors' Association received were mailed to all of our members who were not Ontario Land Surveyors.

Reports Received From Provincial Associations.

1915	Reports received from	Ontario	L.S. Assoc'n.	......	150
1916	" " "	"	" "	......	150
1915	" " "	Alberta	" "	......	10
1916	" " "	"	" "	......	10
1915	" " "	B. Columbia	" "	......	1
1915	" " "	Manitoba	" "	......	1
1916	" " "	"	" "	......	1
1915	" " "	Quebec	" "	......	2
1916	" " "	"	" "	......	2
1916	" " "	Saskatchewan	" "	......	50

As no report was published in 1916, an exchange could not be made as arranged, but the Associations mentioned are listed for an exchange with our next publication.

We appreciate, and are thankful to our sister Associations for the valuable information contained in their reports, which are available to our members. Our thanks are also due the Commission of Conservation for a copy of each of their publications received during the past two years.

Letters Received and Sent Out.

1915—Letters received	75 (on file)
1915—Letters sent out (including circulars)	350
1915—Ballots sent out	200
1916—Letters received	95 (on file)
1916—Letters sent out (including circulars, etc.)	650

In 1915, two hundred ballots for the election of Second Vice-President were mailed.

The official list of Active Members has been revised from time to time, and now tabulates at present as follows:—

Honorary Members	8
Active Members	237
Total	245

An increase in membership during the past two years of eleven.

During the years 1915-16 the following five members have tendered their resignation:—Messrs W. M. Tobey, F. B. Reid, G. S. Jones, C. R. Westland, and H. McGrandle.

The names of sixteen new members have been added to the list.

Forty-one of our members have answered the call to arms for the defence of the Empire. With the approval of the Association, it is the intention to have the names of all Dominion Land Surveyors who have enlisted for Overseas Service printed on a Roll of Honor and inserted in our annual report. The forty-one enlisted members have been exempted from payment of annual dues, in accordance with a resolution passed by our Association, at the last annual meeting.

14 members on Active Service were exempted from fees. . 1915

36 members on Active Service were exempted from fees. . 1916

The difference of "two" in the number of fees and the number of members who have enlisted, is due to the fact that two members enlisted after they had paid their fee for 1916.

During the past two years it has been my painful duty to place the names of seven of our members on the deceased list. Among the number permit me to mention especially, the name of Dr. W. F. King, C.M.G., D.T.S., our late Honorary President. The following members have been killed on Active Service:—Lieutenants L. E. S. Bolton, W. M. Carthew, W. S. Earle, and Lieutenant H. S. Holcroft died in England. All honour to these men who have made the supreme sacrifice.

In addition to these, the following members have crossed the Great Divide: Messrs. J. Brady, and E. W. Robinson. The latter was drowned in Beaver Lake, Manitoba, August 14th, 1916.

Before submitting the financial statement I would suggest that a vote of thanks from this Association be extended to Mr. W. J. Moule, of the Topographical Surveys Branch, who, with the consent of the Surveyor-General, has presented the Association with a beautiful illustration of his ability as an artist in the Roll of Honor of Dominion Land Surveyors who have enlisted for Overseas. A number of these "Rolls of Honor" have been distributed to officers of the Association, the Surveyor-General and other officials of the Department. It is my intention to keep this "Roll" up-to-date, and I would appreciate additional information from any authentic source.

At a meeting of the Executive Committee, held on the 21st December, 1915, it was decided that owing to the great war and other conditions no annual meeting would be held in January, 1916, and that the administration of the Association remain under the management of the same officials and Executive as for the year 1916.

Two other meetings of the Executive were held, one on the 22nd November, 1916, the other, on January 10th, 1917, to discuss general business in connection with the Association, and to appoint two members to the Executive to replace Messrs. D. F. Robinson, and D. H. Nelles, who enlisted for Overseas. The members appointed to act on the Executive are Messrs. G. H. Blanchet, and J. L. Rannie, D.T.S.

The payment of annual fees for 1916, I regret to state, has not been so well attended to by members as in previous years, this being due, I presume, to existing conditions caused by the war.

In accordance with a motion unanimously carried at the last annual meeting, held on Janaury 27th and 28th, 1915: "That a circular be sent to each surveyor asking them to send in a list of the names of the men employed by them during the season, arranging them in relation to their desirability as employees on Dominion Land Surveys." Copies were sent to surveyors, who are members of this Association.

In reply eighteen lists were returned, of men employed during the season of 1915.

A circular form was prepared and mailed to forty surveyors, who are members of the Association, employed on survey work in 1916. To date nine forms only, have been returned.

The financial statement herewith shows the business transactions of the Association for the past two years, and the present state of finances.

RECEIPTS.

Balance on hand, 28th January, 1915	$484 18
Advertisements	46 00
Dinner tickets (32 at $2.00)	64 00
Annual fees, 1912	4 00
" " 1913	16 00
" " 1914	48 00
" " 1915	216 00
" " 1916	170 00
" " 1917	22 00
Government grant for 1915	125 00
Interest	12 38
Commission on cheques	1 65
	$1,209 21

Expenditure.

Chateau Laurier (annual banquet, 1915)	$130 40
Tip to waiter	2 00
Tip to caretaker (Library)	1 00
Vocal music at banquet	5 00
Stenographer's report of meeting	50 00
Patriotic Fund	100 00
Services of projection apparatus	7 00
Printing annual report, circulars, etc	336 25
Grants to Sec.-Treas., 1915-16	150 00
W. C. Murdie, expenses re paper	17 00
Advertisement in papers re postponement annual meeting	20 25
Late Dr. King—flowers	8 00
Stamps and war taxes	4 76
Express charges	3 15
Discount on cheques	4 35
Bank account	358 91
Cash on hand	9 79
For paper	1 35
	$1,209 21

Audited and found correct.

(Sgd.) E. M. Dennis,
G. C. Cowper, *Auditors.*

January 26th, 1917. A. H. Hawkins, *President.*

Secretary Hubbell: I may say, gentlemen, in connection with this report, that we have $370.00 in the bank, and providing that 75 per cent. of the arrears are collected, together with the 1917 fees, we should count on about $400.00 more, besides the Government grant of $125.00. I think some action should be taken by the Association to collect these arrears. It is neglect more than intention with most surveyors.

I have endeavoured to make this report as comprehensive as possible, and would like to have it criticised by any of the members.

The Chairman: You have heard the Secretary-Treasurer's report? I would like to hear some remarks on it.

A Member: I would like to ask the Secretary what will probably be the expenditure for the coming year?

Secretary Hubbell: About $600.00.

Moved by Mr. Watt, seconded by Mr. Seymour, that the report of the Secretary-Treasurer be adopted.—Carried.

The Chairman: In connection with the suggestions made by the Secretary, I think it would be desirable and proper for this Association to pass a vote of thanks for this very excellent report, which he has given us.

Moved by Mr. Lonergan, seconded by Mr. Dennis, that a vote of thanks be presented to the Secretary for the very able and excellent report which he has prepared.—Carried.

The Chairman: Now there is one very important matter that the Secretary has touched on, that is the collection of fees. We have tried to keep up the fees of the members gone to the front, and if we had more money we could do something more. I think it would be a good plan if this Association were turned into a committee and collect these arrears. There may be some excuse, but we need the money, and it is simply because we want to help the fellows that have gone forward that we have to do this. I think it would be a very good plan if all the members of the Association would constitute a committee having charge of the collection of fees.

Secretary Hubbell: You will note that the printing of the last annual reports cost $376.00, and we anticipate spending at least an equal amount this year. I have received requests from Presidents of Universities of the Western States, and from other institutions asking for copies of our reports, and as far as possible, have obliged them. Out of 450 reports printed last year, we have only about fifteen left. I have in my office, copies for each year since 1911. I think we should retain a few for reference.

Mr. Rannie: In regard to these members who have not paid their dues, I fear it is largely a matter of indifference whereby these members get in arrears. They get in arrears because they have not a sufficient active interest in the Association; perhaps few of us take a sufficient interest in the Association. We leave the work of the Association to one or two men. I feel, however, that the members of this Association in general do not realize what a help the Association is to the members. I do not know that I quite realize this myself. But could not a circular-letter be addressed to the members who are in arrears, and which would be intended to impress upon them the good that the Association has done and is doing for all Dominion Land Surveyors; would not such a circular have the desired effect? Tell them what has been done in the past, that it is due to the Association that the remuneration of the men has been made what it is to-day, one of the highest paid professions there is anywhere. Could not a final effort be made to get some of the arrears at this time when the Association needs all the money which it can get? I have personally spoken to some members whose fees have been in arrears, and one of them said: "I don't mind my dues being in arrears, but some one told me that it was partly due to the Association that I am getting my present salary. If that is so, I have four years' arrears I had better pay up." I think there are quite a few members in the same predicament and I think the printing of some circular or pamphlet would well repay the Association.

A MEMBER: Where are most of the arrears located? Out West? We should get a local representative out there to get after them.

SECRETARY HUBBELL: I consider Mr. Rannie's suggestions are well worth the consideration of every member of the Association. A person who has not been secretary of an association such as ours, cannot have any idea of the trouble there is in collecting fees, I have again and again notified members of their arrears, and in many cases, do not receive an acknowledgment.

There is apparently some excuse for this omission by the surveyors engaged in field work, as it frequently happens the mail service is uncertain and unreliable, and in the confusion of keeping track of details, minor matters (such as fees) are apt to be overlooked for the time being.

When we think it over, the Association has been the means of accomplishing a good deal that is beneficial to surveyors in general, among other benefits derived, I might mention the following:—

Increase of pay to surveyors.

Increase of pay to labourers and cooks.

Increase to ration allowance.

Increase in contract rates.

The adoption of the new survey post.

The markings of witness posts for section corners.

The publication of valuable scientific papers of interest to surveyors and others.

Discussion at the annual meeting of subjects interesting to surveyors and to the advancement of the profession.

The recognition of the Association by the Honourable, the Minister of the Interior and other officials of the Government.

The obtaining of the I.S.O. for the Surveyor-General.

The abolition of appointments to survey parties by members of Parliament and the Government.

A Member.—Would it not be a good idea if a paper be prepared presenting the advantages of the Association?

Secretary Hubbell.—Yes, but most of the information is to be found in our annual reports.

The Chairman.—Mr. Lonergan, let us hear from you.

Mr. Lonergan.—In regard to the suggestion that you made, that all the members get after members in arrears, they would need a list of the members in arrears. Give all the members in good standing a list of the members in arrears. I think this is a step in the right direction, if one member would be given the names of five or six members who are in arrears to look after.

Secretary Hubbell.—Yes, that's the idea, now we are coming to it.

The Chairman.—Mr. ———, could you tell us something we might do?

Mr. ———.—Let me say one word. You say most of the delinquent members are from the West. There is an example that one of the very best means of getting enthusiasm is by the members coming right to the meetings of the society. In this way there would be more members who would pay up their arrears than there would be by sending a thousand letters. But when you give those members something to think about, something which means their bread and butter to keep up their membership in this society, I think they will get that interest which they are unable to get by not being here. I think if a circular-letter could be written, its form might be discussed at an executive meeting of this society and it could be printed at a very low cost and sent to the members, it would be a good idea, and I think that it would have some effect. If just to put the matter in concrete form, I would like to make a motion that the executive of the Dominion Land Surveyors' Association have prepared a letter which should be forwarded to the members who are in arrears, and await results.

A Member.—May I ask how many members are in arrears?

Secretary Hubbell.—About thirty over three years in arrears.

A Member.—Why not have a committee appointed and trust them to write a letter to those members? Surely some member of the committee can do that.

Secretary Hubbell.—I think one letter would cover all that is necessary, and I could forward it to the members in arrears. The suggestion by Mr. Lonergan is a good one, that when members in good standing are surveying in districts where some of the members in arrears are at work, that they bring this matter to their attention. There is a gentleman we all know (he is giving us a paper that is to be read to-morrow) who was on the inside service for a number of years, he is five years in arrears, still he is giving us a paper. Another case: there are two surveyors who have been working for the Department for some years, they have not even joined the Association, yet they reap the benefit of all that is done by the Association. I wrote them a note some time ago, expressing pretty strongly what I thought, but have not been honoured with a reply.

THE CHAIRMAN.—Gentlemen, we have had a number of very good suggestions on this matter of collecting fees, but my own opinion is that we might discuss it for a longer time and not arrive at any definite conclusions. I beg leave to appoint three gentlemen on a committee and allow these gentlemen to express in a concrete form, an appeal whereby we can hit the members in arrears in order to get the fees due. Messrs Lonergan, Watt, Seymour and the Secretary, Major Hubbell. Now think this over and report when it comes to the item of unfinished business and let us get some scheme in a complete form.

MR. RANNIE.—I heartily second your motion and in doing so I withdraw my previous one.

THE CHAIRMAN.—Thank you. When you have a number of motions, it is hard to get to any conclusion, but when these gentlemen get together they can form some idea of what we should do. Is there anyting further, gentlemen?

SECRETARY HUBBELL.—Nothing further. This afternoon, with your permission, Mr. President, I would like to announce that we have two excellent papers. The first by Mr A M. Narraway, D.L.S. on "Suggested changes on subdivision methods of Survey"; probably some of you have heard about it. The second paper entitled "Method employed in chaining Sixth Meridian," is by J. R. Akins, D.L.S. I think Brother Fawcett should ring up the Observatory and bring in all the staff, they cannot afford to miss these papers.

The Association took recess.

The Meeting resumed at three o'clock p.m. Mr. Hawkins presiding.

THE CHAIRMAN.—Gentlemen, if you will come to order, we will go on with our meeting. The first number on the programme this afternoon is a paper by Mr. Narraway, on a new way of subdivision.

SUGGESTED CHANGES IN METHOD OF SUBDIVIDING TOWNSHIPS.

By A. M. Narraway, D.L.S.,
Dept. of The Interior.

As most of you are aware, a revision of the Manual of Surveys is taking place, owing to the many changes in the instructions during recent years. The following suggestions for changing the method of subdividing townships are being considered, and it is desired that they should be thoroughly discussed before they are incorporated in the new Manual.

In our subdivision surveys up to the present time, we have depended on the township outlines for the control and the accuracy of the interior subdivision. This has meant that in many cases where townships, desired to be subdivided, adjoin the correction line, several outlines have had to be run through an unsubdivided country at considerable expense. To bring an outline down from the base line to the correction line in unsubdivided country, it requires that the main party be split, which is never desirable or economical, and further, in addition to the actual outline to be surveyed, there is a large amount of trail cutting required. For this reason in laying out the subdivision work for a season, due regard has been given to the positions of the townships to be subdivided by each surveyor, but such planning of work, economic from the surveyor's point of view though it be, cannot always be adhered to. Townships must be surveyed according to the demand for settlement, according to certain topographical features, and according to other natural resources. This inability to always plan the work in the most economical way, will result in many cases in having to run lines in unsurveyed country, and therefore any method which tends to eliminate this difficulty, even to a small degree, is worthy of consideration.

Again, owing to inaccuracies in projecting the outlines it has been very difficult to run the north or south boundaries of the township accurately. These boundaries have had to be re-run very frequently in order to conform with the Act. It has been suggested again and again that some limit be set within which the trial line for the north or south boundary might strike and not have to be re-run, but deflected, but this has never been permitted, possibly on the grounds that the strike does not often fall within the limit desired. Several attempts have been made from time to time by the surveyors in the field to work up some scheme which would enable them to hit close enough to the post to save re-cutting the line, but these attempts have never become common, even though in a few cases considerable success was met with.

One of the chief obstacles in the way of a close strike with this boundary has been poor chaining or having two sets of chainmen, one set on each outline. Two sets of chainmen, unless special precautions or corrections be used, will not chain the same, and therefore no matter how accurately the transit work has been done the closing error will be large.

Further, the larger part of the accuracy of the subdivision devolved upon the chainers, and not upon the instrument men, who have been trained for such work. At the beginning of the season the average subdivision party starts off with inexperienced chainmen, but with qualified assistants, and then these inexperienced men have thrust upon them the hardest part of the work, while the assistants are furnished with very accurate and precise instruments. The transit man sets up on all the dry spots in a wet country while the chainer must go through all sorts of wet stretches, and is expected to keep the accuracy of his work up to the usual standard. This standard must be high, as according to the present subdivision method, the monuments on the outlines and meridians are planted by accumulating chainages with the corresponding accumulating errors. Now while the chainer's work must be so accurate and such accuracy so hard to sustain, it would be expected that the chainmen would receive higher remuneration than the transitmen, but the reverse is the case, and the transitmen receive from 3 to over 4½ times the amount paid to the chainmen. And yet the transitman must be in charge of the axemen in order to obtain the maximum amount of line cutting each day, and this could not be done by an inexperienced man such as used for chaining. The speed of the party therefore very often is increased at the expense of accurate work.

The following method of subdivision is based on the central meridian, and is designed to overcome to a very large extent, these difficulties and objections, by reducing the outlying lines and trails to a minimum; by doing away with the re-running of the north or south boundary of the township entirely; and by placing the bulk of the responsibility of the survey on the shoulders of the transitmen who are at present paid a sufficient amount to be expected to carry it. It is expected that the whole work in the township will be carried out more accurately and at less cost, and therefore this method is submitted for your consideration on these grounds.

After the establishment of the base lines the next operation is the survey of the Central Meridians of townships.

A Central Meridian is started at the section corner on the base line, and run due north or due south to the correction line where a temporary post is left. The corresponding meridian is then surveyed from the section corner on the next base to the same correction line; and the connecting jog run, and the north and south closing error is distributed equally between the two quarter sections.

The north or south township outline, midway between the base line and the correction line, or a chord is turned off this Central Meridian and run due east and west as a straight line. The section and quarter section corners, and township corners, if not already established, are then established on this line at theoretic chainage.

The lengths laid out on the Central Meridian and on this township outline, midway between the base line and the correction line, or on the chord, should be measured twice. Two tapes should be used, one divided into chains and links, and the other one into feet. Where a triangle is resorted to for passing an obstruction the operation should be checked by another triangle in order to conform to the principle of double independent chainages.

Now, a township adjoining the correction line is subdivided by running the meridional section lines and outlines from the township outline or the chord thus established, and then running the remaining chords, as straight lines east and west from the Central Meridians. The section corners, and township corners not already established, are then established at the intersection of these meridians with the chords.

Again, a township adjoining the base line is subdivided by running the meridional section lines, including east and west outlines, from the base line, or from the township outline, if previously run as a control line; and the chords east and west as straight lines from the Central Meridian. The section corners are then established at the intersection of the chords and the meridional section lines.

When running meridional or chord section lines temporary marks are placed at the section and quarter section corners at theoretic chainage. When the intersections are made the lengths of the quarters may be altered. If the meridional section lines have been run a considerable distance before the chord lines are run to establish intersections, there will probably be an accumulated error in the positions of the temporary marks. In this case, permanent section monuments are established at the intersection points, and ties made to the temporary marks placed on first line, but the permanent quarter monuments must be placed midway between the section corners, unless the difference is small. However, if the chords have been surveyed at the same time as the meridians, which will nearly always be done, then the temporary marks should not be far in error and the permanent quarter monuments may be established in the positions of the temporary marks.

In closing meridians or east and west lines, on corners already established, only the last quarter section is deflected. In the present method the outlines are made straight and on other meridian lines the last mile is deflected.

The topography of the townships being subdivided may be such that the Central Meridian would be difficult to establish with the necessary accuracy and precision, in such a case the surveyor would be expected to run a meridian other than the Central Meridian as a control line. It will be left to the discretion of the surveyor whether he should run the township outline midway between the base line and the correction line, as a controlling line, or whether he should choose some other chord in the interior of the township for this purpose.

Where a quarter section corner falls in a lake, and is not witnessed, the quarters are to be made equal.

Oral description, using blackboard, to be given now, showing some of the changes.

You will see at once that the accuracy of the work depends primarily on the care with which the Central Meridian and the chord control line are run. It would be preferable to have all transit sights at least thirty chains in length. Frequent observations should be taken to ensure an accurate direction of this line.

Because of complications and difficulties arising in future surveys, it is greatly desired that deflections, other than in the closing half mile, should be guarded against. It has been suggested that even in case the Central Meridian is found to be in error, it should be produced to the boundary of the township, and then deflected at this point an amount sufficient to bring the end of the line, at the correction line, into true position. The other meridians and chords should not be very much in error as they will all be turned off very accurate lines.

A deflection will occur occasionally in a township outline, but this deflection is confined to the closing half mile and should be small. It follows that with this method in force the township outlines will be of no more importance than the interior section lines.

Many of you have noticed that one set of chainmen will persistently chain longer per mile than the other set, and in order to have small closing errors for your blocks you have made an allowance for one set, which they apply every half mile. Now while you have equalized the work of these chainmen, it is unlikely that you have allowed for all the personal error. You have assumed one set to be chaining a true mile. It has been my experience to find that too strong a pull is given unless a spring balance be used, and that some correction should be allowed, where the chainmen are allowed to use their natural pull. Would it not be advisable to apply in subdivision work, the present base line check, say once a month, to determine this correction? This check consists in measuring (on hubs), with the Standard, a half mile of line which had previously been chained by both sets of chainers. The level is used instead of the clinometer for determining the slope corrections. If, however, a test be not made similar to this test, some equalization between the two sets of chainers should be attempted.

It is also open to question whether or not temperature should be taken into consideration in chaining the Central Meridian. Those surveyors who have used the thermometer on line seem to be in favour of it, but others think that it might be dispensed with. On base line parties the thermometer is used throughout, and no difficulties are experienced, either in determining the temperature to the nearest ten degrees, or in making the corrections.

In the method just described you have noticed that the transitman has been given a large amount of responsibility, and his work is far more important than it has been up to the present, and yet we have given him fewer angles to turn. His work controls absolutely the chainers' work, and outside the control lines the errors in chaining can only affect the position of the quarter section corners, and cannot be accumulative. Even though the chainer may record the wrong distance for the quarters we have the saitsfaction of knowing that the error in a section monument is in the notes and not on the ground to be discovered by the settlers.

Offsetting of posts is one of the weakest points in the present method of subdivision. It is the experience of inspectors of contract surveys that probably the hardest test as to the accuracy of the subdivision is to retrace a chord across a township, because it is frequently found that the quarter section monument has not been placed as shown in the survey notes. The reason being that the post, in accordance with the present method, has generally to be offsetted and that after the line has been run. As it means a waste of time to send the chainers and a transitman back to offset the post, the really important point of permanently marking the survey accurately on the ground, *i.e.* planting the posts in accurate position, is too often left to the mounder. It is obvious that the ideal method is that which will permit of the transitmen and the chainmen, who are responsible for the accuracy of the survey, to place all posts in their permanent positions, without such a waste of time. The proposed method is designed to meet this difficulty.

In the present method of subdivision a great deal of attention has been paid by many surveyors to the various limits of error set in closing, considering that within such limits their work would be considered acceptable. These limits of error were set when the townships were subdivided under the contract system and were necessary for the guidance of the surveyor and for the protection of the Department. However, the accuracy of work done under the day system has been improving, and with the suggested method it is proposed to do away with all limits of error as the possibilities of serious errors have been greatly minimized, and the surveyor is expected to use his own discretion in deciding what is good work, and what is not, and what is the wisest course to adopt under certain difficulties.

In flat or gently rolling country, under the present method of subdividing townships, it is found that when all the measurements around a section are made by one set of chainmen, and the lines run with a moderate amount of care, the closing error is usually well within five links. Over marshy ground or muskegs, the closing error reaches 10 or 15 links.

The same agreement cannot be expected when the measurements are made by different sets of chainmen, even though their chains may be identical. There is a personal error which may amount to as much as two links per mile.

Now, in conclusion, I would again point out that it is very important that this method be discussed, and suggestions for improving it in any respect would be welcome. In your discussions I would be glad if you will include the following points which present some difficulty:—

1. Should the Central Meridian be commenced without obtaining an observation, and later it is found to be in error, due either to an error in turning the angle or to an error in the line from which it is turned, what should be done? Should it be deflected or carried through across the township and deflect at the township boundary?

2. Should corrections be made on the Central Meridian for temperature and for chain personal errors?

The Chairman.—Gentlemen, I am sure you have listened to Mr. Narraway's paper with a great deal of interest. I think it contains plenty of matter for very good discussion on this question. I hope you will look after this.

Mr. Seymour.—I would like to move a vote of thanks to Mr. Narraway for his paper, and I suggest that he occupy a position beside the blackboard and answer a few questions before we start the discussion. I think there are a few points which we would like to have discussed.

Mr. Narraway.—I would rather have the discussion made by the members present and note will be taken of any objection or question about this system.

The Chairman.—Mr. Seymour has made a motion for the presentation of a vote of thanks to Mr. Narraway for his very excellent paper. Will some member second that motion?

Moved by Mr. Seymour, seconded by Mr. Lonergan, that the Association present a very hearty vote of thanks to Mr. Narraway for his excellent paper. Carried.

The Chairman.—We are now open to discussion of the new system of subdivision. We would like to hear from the members.

Secretary Hubbell.—Mr. Chairman, I have heard with great interest Mr. Narraway's very able paper. I am not going to make criticism of the paper at present. Now, I wish to tell the members that every one here should make some suggestion and take part in the discussion. Speak up, don't be afraid. The papers are brought forward with the idea of having them discussed. Anybody can make some suggestion, find fault with the system or make some comment. Mr. Narraway will answer it. It will be too late after to-day.

A Member.—I would like to ask Mr. Narraway if the outline between two townships is really a correction line and is to be posted on both sides of the road allowance?

Mr. Narraway.—No, one set of monuments are erected for both townships.

Mr. Lonergan.—Suppose a surveyor makes an error and he carries that error throughout the township. Suppose he is correct in running the centre line through the first township but he makes an error in the second township, what does he do? Do you choose the corresponding meridan on the other side of the correction line if you do not choose the central meridan at first? Sometimes these errors are small and they can be omitted, but if the subdivision is carried on, they should be taken into account. There is a large variation there.

Mr. Watt.—I have followed this system myself except in reference to placing the corners at the intersection of the lines. The central meridan was surveyed right through and the chords run east and west from it straight across the township. The more closely the system is followed the better the results. It seems to me, however, that enforcing such a system is wrong. It would be too inflexible in difficult country.

Mr. Lonergan.—One more question I would like to ask. Suppose you are locating the correction line and you run East to the monument located at the North East corner of the township, and the line you run struck South of the post, or North, a couple of chains, would you move the correction line or what would you do?

The Chairman.—Mr. McGarry, we would like to hear from you.

Mr McGarry —If the central meridan reached the outline in error and this corner was established at theoretic chainages would not the township corners be incorrectly established?

Mr. Narraway.—These points have been brought up before this meeting and are being considered, and I would like to hear some suggestions from the members as to the best means of overcoming them. The choice is left to the surveyors' best judgment whether he chooses the township line or another chord as a control chord. In connection with the statement of Mr. McGarry's making that quarter-section on one side of the central meridan longer than the other, it seems to be impracticable. The chances are that not only the central meridan would be off, but the chords turned from it would be considerably off. You might possibly be off a minute and when you discover it you have probably subdivided a considerable portion of the township.

A Member.—Having had the system described to me in the office, I agree with it very much. It all seems to help the speed of the work right through. I have not got anything to say against it at present.

Mr. Cote.—Referring to the central meridan, the surveyor should not be allowed to run it until a complete set of observations are taken.

Mr. Leblanc.—The central meridan is carried six miles North through the township. If we have good observations on the line, and it is out, say a minute or a minute and a half, will the meridan be left as it is and posted? From this point on the North outline will the meridan be deflected across the next township to the correction line? In starting the meridan from the North-East corner of section 34 running North, I would suggest that the chainage of every quarter-section should be left 40 chains, as in the old system.

MR. SCOTT.—The system presented by Mr. Narraway is good; it will save a lot of time and to me it seems better than the old system in which the chord lines are not straight, in this case they are.

A MEMBER.—Would there be any objection in using any other meridan instead of the central meridan?

MR. NARRAWAY.—The central meridan is chosen on account of the accuracy that can be best obtained by its use.

MAJOR HUBBELL.—We would like to hear from some other members. Like Mr. Seymour, I am pleased that we have something new in this line. It is apparently an improvement upon the old system.

MR. WATT.—The object in view in changing to this new system is to gain speed and accuracy, but the attainment of the end in view may be entirely defeated by laying down inflexible rules when the conditions under which the work is done are so variable. If you want the best results from any man you must tell him just what you want, but let him follow out his own methods in obtaining the result.

MR. FAWCETT.—In reference to the discussion which is now going on, for my part a great deal depends on the conditions in which the survey is made, that is the way we get at the work. I like all the liberty possible; like Mr. Watt, I would not like to be tied down as it might make a great difference in the cost of the survey.

THE CHAIRMAN.—Mr. Narraway, will you take up the matter of those questions now?

MR. NARRAWAY.—I would like to consider the several points brought up before answering. I would be glad to hear from any of the members having any suggestions for overcoming the difficulties raised.

SECRETARY HUBBELL.—I wish to take advantage of this opportunity to express my appreciation of the number here this afternoon; it shows that the members and others are taking a keener interest in the Association. It is to be hoped that the members work more together for the advancement of the profession, by so doing we shall more readily obtain our object than by individual efforts.

THE CHAIRMAN.—The next paper to be presented to this Association is one by Mr. Akins: "Methods employed in chaining Sixth Meridan."

This paper not received in time for publication.

THE CHAIRMAN.—You have all listened with great interest to Mr. Akins' very concise and very interesting paper. We would like to hear from members of the Association.

MR. RANNIE.—There is just one question I would like to have answered. I have listened with great interest to Mr. Akins' able paper. I understand that the tapes were standardized and that he was provided with a table giving corrections from the different slopes. Can you tell me how those corrections were obtained? Now that correction is found when the two ends of the tape are at different heights. Is it obtained theoretically or empirically?

MR. AKINS.—It is obtained theoretically.

MR. DODGE.—The slope correction table for measuring in the catenary was computed in the office by Mr. Barry. Mr. Guillaume, of the International Bureau of Weights and Measures at Paris, has investigated very fully the problem when the tape is suspended in catenary with the ends not at the same level. Mr. Parry in computing his table used the formulae derived by Mr. Guillaume.

MR. RANNIE.—I am subjecte to correction, but I understand when the two ends of the tape are not at the same level the catenary is not true. I believe that it is a very difficult curve to calculate. The subject is one that interests me and I would be glad to have more information as to just how that slope correction is calculated

DR. DEVILLE.—The curve is still a catenary when the two ends of the tape are not at the same level, but if the difference of level is great, the approximate methods for calculating the correction are no longer sufficiently accurate. I do not know that any one has actually measured the sag and correction under such conditions; they are measured at the laboratory with the two ends at the same level, but not otherwise.

MR. DODGE.—May I say that Mr. Akins has given a lot of time and study to evolving some system of chaining which would considerably improve the accuracy, while at the same time practical and not too costly. The method which he has described has been in use for two years now and appears to give good satisfaction.

MR. FAWCETT.—I do not think that I have anything much to say. Of course, on the Quebec-Maine Boundary our method of measuring is rather slower than that of Mr. Akins who can make a mile and a half a day. Of course, the country we are in is not the same as that where he was. Ours is much rougher and very mountainous.

Moved by Mr. Rannie, seconded by Mr. Dodge, that the thanks of the Association be tendered to Mr. Akins for his very excellent paper. Carried.

THE CHAIRMAN.—Gentlemen, I am just reminded by the Secretary of three very important points to bring to your attention. The first is that you all are to come to the meeting to-night; the second is that he has a good supply of tickets for the dinner to-morrow night; and the third is that he is prepared to give receipt for the membership fees of the Association to any one wishing to pay them.

The meeting will stand adjourned.

EIGHT P.M. SESSION.

THE CHAIRMAN.—Ladies and Gentlemen:—It is about time that we start our evening's proceedings. So far, we have had two very successful sessions of this Association; the meeting this afternoon was an exceptionally good one; it brought out many good points and the members took great interest in the matters brought before us. We have, this evening, two subjects that will be of great interest to all that have come. There are many attractions around the town and the surveyors get here only once during the year so they make good use of their opportunity. We will go on with our program. In the first place, Mr. Rannie will present a paper on "A Few Thoughts on Geodesy."

"A FEW THOUGHTS ON GEODESY."

By J. L. Rannie, D.T.S.

Presented at the meeting of the Dominion Land Suryeyors' Association, Jan. 31st, 1917.

Geodesy is that branch of science which treats of making extended measurements on the earth's surface and of related problems.

Whatever one's view point, no matter what aspect of the subject one considers, a large scope is presented.

From a historical outlook geodesy is one of the oldest of sciences, dating back to before the second century before Christ, when Erastosthenes and the famous school of Alexandria produced a measure of the earth's circumference only about 15% in error. The modern era of geodesy is not quite so old beginning, as it did, in the seventeenth century, when Newton discovered the existence of the law of universal gravitation with its corollary of the slight flattening of the earth at the poles.

From the point of view of development there is also presented a large field. At first we find the determination of the figure and dimensions of the earth to have been a fundamental object. Now we find that the object of geodetic work is to furnish precise locations for the controlling points of extensive surveys all over the world with allied problems, and its importance is recognized by all civilized nations, each of which maintains large organizations for this purpose.

Perhaps we may obtain the best idea of how broad a field of investigation is covered by this subject if we consider the scope of the topics covered and involved by modern geodesy.

These may be divided into three main classes with their subdivisions as follows:—

A. *Field Determinations* containing errors and discrepancies

1. Triangulation.
2. Astronomical Observations for Latitude, Longitude and Azimuth.
3. Measurement of Base Lines.
4. Precise Levelling.
5. Soundings.
6. Tides and Tidal Phenomena.
7. Gravity.
8. Terrestrial Magnetism.

B. Office Investigations.

1. Adjustment of Observations.
2. Computation of Geodetic Positions.
3. Correlation of Geodetic Positions with other Surveys.
4. Selection of a Datum Plane.
5. Figure and Dimensions of the Earth.
6. Deviation of the Plumb Line.
7. Anomalies of Distribution of Matter.
8. Refraction.
9. Map Projections.

C. Publication of Maps and Results.

With such a wide range one would think it a comparatively easy task to select a subject for this talk. It seemed hard, however, to deal with the subject in a way which would be profitable and interesting without dealing with the phases of geodesy with which you are all more or less familiar. I wished, moreover, to avoid tiresome details of cumbersome operations, so the subject "A Few Thoughts on Geodesy" was selected in the hope that a better conception might be imparted of a few of the broader principles which those in charge of a geodetic survey must constantly and strictly bear in mind.

Let us just refresh our memories with some of the objects of a trigonometrical survey so we may have a number of arguments at hand in case we are asked the question, "Why do all civilized nations maintain large organizations for the prosecution of these surveys?"

In answering this question I wish to bring to your attention the stand taken by the Dominion Land Surveyors' Association on this subject, and feel that I cannot do better than quote from a memorandum prepared by a committee appointed at the fifth annual meeting of the Dominion Land Surveyors' Association, held at Ottawa in March, 1888, to consider the question of a trigonometric survey of the Dominion. This committee was composed of the following men:—

Otto J. Klotz, D.T.S.
W. F. King, D.T.S.
W. S. Drewry, D.L.S.
E. J. Rainboth, D.L.S.
J. S. Dennis, D.T.S.

Let me just put the argument in a few words. Justify the building of a house for me and the same reasons hold for building a foundation for that house. A justification of a topographic survey along our coast lines, waterways and in the more densely settled parts of our country gives us reasons why geodetic surveys should be prosecuted. It is just as reasonable to propose building a house without a foundation as it is to think of starting topographic surveys without having their accuracy controlled by a geodetic survey.

Excerpts from the memorandum, in-so-far as they apply to the advantages of a geodetic survey, are here given verbatim:—

"The question of the value and utility of a trigonometrical survey has been so settled by almost every civilized nation, that it is hardly necessary to advance proof of the statement that it would be of immense practical value to the whole Dominion; but for illustration and in support of the statement, the following facts are offered.

"The surveys of this kind, which have been made by other countries, may be briefly referred to.

"First and foremost is the Ordnance Survey of Great Britain and Ireland, covering nearly 111,000 square miles, which was begun in 1784 and is now (1888) nearing completion. Then comes the great Trigonometrical Survey of India, inaugurated at the beginning of the present century by Colonel Lambton, which is still in progress and of which the beneficial results have been inestimable. Belgium is carrying on a survey which, when completed, will furnish 450 sheets of map on a scale of $\frac{1}{20000}$ with contour lines one metre apart.

"Prussia is carrying on an extensive survey and since 1849 has introduced new and more perfect methods. Russia, with its enormous territory, about twice the size of the United States, including Alaska, has been for many years engaged in prosecuting trigonometrical surveys.

"Norway, although a comparatively poor country, has set itsself on having a good topographical map, on a scale of $\frac{1}{10000}$ compiled from trigonometrical surveys.

"Austria has completed a new map of the Empire, comprising 715 sheets also compiled from data furnished by trigonometrical surveys.

"Denmark, Switzer and, Spain, Portugal and Italy are all carrying on trigonometrical surveys, to enable them to map their territories accurately.

"France has completed her survey and the result is shown in 276 sheets of map.

"On this continent surveys of a high order of precision have been made by the United States Government, and the work of the Coast and Geodetic Survey is going steadily on, having been extended along the sea coast and also along the Great Lakes, and many of the States and Territories have been covered by its operations, including some in the far West, viz.: Nevada, Colorado, Utah, New Mexico, Montana, Idaho and part of Arizona.

"Several of the States have conducted independent trigonometrical surveys of their own territory, including Massachusetts, California, New Jersey and New Hampshire, and in other States they are in progress.

"All the foregoing surveys are based on triangulation.

"It may be asked what are the practical benefits to be derived from a trigonometrical survey, and what is there to justify the expenditure of the large sum of money which a survey of this kind would ultimately cost. To make the point of practical benefit clear, the following will be readily understood by all:

"It is stated by an eminent American Engineer that "If the State of Massachusetts had had a good topographical map in 1838, some $20,000,000 would probably have been saved in its public railway expenditure."

"Mr. Sandford Fleming, C.M.G., in his report to the Minister of Public Works, dated April 5th, 1879, says: "If the Railways of Ontario had to be established 'de novo,' a careful study of the requirements of that Province would enable any intelligent engineer of ordinary experience to project a new system which at one half the cost would far better serve the public and would meet every demand of traffic, would more fully satisfy every expectation, and which would not result in disappointment and loss to those who have been induced to invest their means in that which has proved to many an unprofitable undertaking."

"If to-day a railroad is projected in England, or any other country possessed of a good topographical map, preliminary surveys such as we are obliged to make are unnecessary, for from these plans the lengths and grades of any proposed line can be determined with sufficient accuracy to enable a final location to be made.

"In carrying on a survey of the character contemplated, it is necessary to run lines of exact levels from station to station and thus we would have the elevations of points all through the settled portions of the country, and in future operations, in which levelling is a feature, all levels could be referred to a common datum line (sea level for instance) and when railway lines are pushed back into the wooded interior, the physical character of which is but little known, we would then have some definite idea of main watersheds and valleys to guide future operations, instead of relying, as is at present done, on guess work and hearsay evidence.

"Among other benefits to be derived from a survey of this kind, are the following: Our extensive coast line, both in the Gulf of St. Lawrence, on the Atlantic and Pacific seaboards, and also in our inland waters, has been very roughly determined in many places and in consequence many disasters happen to shipping and many valuable lives are lost annually, which would in a great measure be avoided were we in possession of reliable charts of our waters; and one of the first requisites in making the hydrographic surveys, necessary to provide the data for compilation of these charts, is that certain points on the shore should be accurately fixed. It may be mentioned in connection with the Hydrographic Survey of Georgian Bay, at present (1888) being carried on under the direction of Staff Commander Boulton, R.N., that Commander Boulton stated before the D.L.S. Association, at its last annual meeting, that in making his survey he had not been able to connect his work with any point accurately determined by Canadian authority, but had to use points established by the United States Coast and Geodetic Survey.

"On our inland lakes and waters large sums are annually spent in harbor and other improvements and yet the geographical positions of these harbors and waters are not accurately shown on any map or chart.

"A large sum has been spent in building the Murray Canal between Lake Ontario and the Bay of Quinte, but there is no correct chart of the Bay and a stranger attempting to navigate a deeply laden vessel in its waters would probably meet with disaster. This has happened time and time again and will continue until we have an accurate chart of the Bay, and as has already been said, the work of making these charts would be greatly expedited by having points along the shores established by a trigonometrical survey from which to begin the hydrographic survey.

"Numerous isolated surveys have been made under various departments of the Government, at points on the Atlantic coast, the Gulf of St. Lawrence and in the Great Lakes; it is also proposed by the Militia Department to make a series of reconnaissance surveys at different points; all thses surveys, made or to be made, give valuable results, but they cannot be considered complete until they are connected. To this end a carefully executed triangulation is necessary.

"Again with the increase in the value of real property, any work having in view the permanent marking of points which would definitely fix the positions of boundaries of real estate, is for the public good. In many of the Provinces the boundaries of valuable properties are in most cases dependent on the durability of wooden posts, a few marks on trees, or the testimony of a few of the oldest inhabitants, and as a consequence expensive litigation often arises; in fact it may safely be said that the amonut annually expended in litigation regarding boundaries would go a long way towards paying for the cost of a trigonometrical survey.

"Were the boundaries, especially those of large areas, such as counties, townships and concessions, accurately defined by a trigonometrical survey, similar to that made by the countries herein referred to, all doubt as to their position would be forever set at rest.

"At the present time, throughout the Dominion, every city and many of the towns and villages are looking about for means of obtaining a good water supply or of improving the supply they have.

"Gravity being the best method of utilizing a water supply, is generally first sought after, but the information necessary to determine the availability of a supply by this means can now only be had by expenditure of large sums in surveys, as has been lately seen in Toronto.

"Had there been a goood topographical map in existence that expenditure would have been unnecessary.

"In drainage work the information derivable from a survey of this kind would be invaluable, and as our agricultural population is waking up to the benefits arising from proper drainage, no time should be lost in giving them this aid. The maps would enable any engineer to determine by a simple calculation the area of any basin to be drained and to know accurately the size of drain necessary and its proper location and the survey would do away with all litigation arising from parties claiming that their lands do not lie in the basin to be drained, as a reference to the map would show at a glance the natural drainage outlet for any piece of land.

"These maps would also be exceedingly valuable in assisting an equitable assessment of real estate for taxes and in providing the necessary information required in locating and building public highways and would save large sums of money which are now expended in finding out where roads should be built; and the sums so saved might be expended in making the roads more solid and permanent.

"The information afforded by the maps provided from a survey of this kind, in reference to our inland waters and the possibility of their utilization for navigation which is becoming every day of more importance, would be of vast benefit to the country.

"Many large public works are now being agitated and will no doubt in the near future be undertaken, as, for instance, the "Ottawa Ship Canal," the "Trent Valley Canal," etc., the possession of good topographical maps would very naturally assist in settling the question of the feasibility of these and many other schemes for the improvement of navigation, etc.

"Instances might be cited indefinitely to prove the value, not only to the Government, but to the people at large of a trigonometrical and accompanying detail survey of the kind herein referred to, but it is thought that enough has been said to conclusively show the benefits which would accrue therefrom.

"The advantages accruing to the country by a geodetic survey would not be confined to the definite material advantages gained in topographical knowledge and the coast and sounding surveys based upon the triangulation.

"An additional and not inconsiderable advantage would be the stimulus given to scientific research. It has been the experience of other countries that men employed on geodetic surveys, having their attention drawn to the numerous branches of science involved, have, by their scientific and mechanical inventions, added greatly to the sum of knowledge in these branches and indirectly to the material wealth and progress of the countries."

It is interesting to note that the president of the Association in 1888 was Mr. Thomas Fawcett, D.T.S., who is at present attached to the International Boundary Surveys.

The Ontario Land Surveyors Association also has for the last twenty years been most zealous in its requests for and support of triangulation surveys of our Dominion.

Quite an illuminating comment has just come to the notice of the writer from a most unexpected source—the Report of the Trigonometrical Survey of Fiji. Just an extract from its introduction:

"With the greater development of the country, the difficulty of reconciling the location and acreage of some of the earlier and less accurately defined properties with the results of recent contiguous surveys began to be severely felt, the fitting of new plans into old maps being sometimes impossible. This difficulty is of course by no means new, being experienced by almost every civilized state at some period of its development. *By all progressive governments, as soon as the resources of the State permit, it is met in the same way—by the initiation of a primary survey eventually embracing the whole area of the country.*"

The datum for the Fiji Islands surveys was based on latitude and longitude of a pillar at Suva, determined in 1903 by Dr. Klotz and F. W. O. Werry in connection with the determination of trans-pacific longitudes, a fact in which we may take a pardonable pride.

In connection with our Geodetic Survey which was started in 1906 and organized in 1909, the observing has been completed over an area of about 66,000 square miles of land and water, the distribution of this amount being about as follows:—

Maritime Provinces, largely in the vicinity of the Bay of Fundy, about..........	8,000 square miles.
Quebec, on both sides of the St. Lawrence and Ottawa Rivers from Riviere du Loup to Ottawa and covering the whole of the Eastern Townships, about......	20,000 square miles.
Ontario, from Montreal to Collingwood and Windsor and about 2700 square miles in the Port Arthur region, about...	27,000 square miles.
British Columbia, from Victoria and Vancouver north between Vancouver Island and the mainland, together with a scheme beginning at the Portland Canal which is to be extended southward to meet the triangulation from the south, about..........................	11,000 square miles.
Total, approximately...........	66,000 square miles.

You will note that the areas covered by our geodetic surveys have been such as to give control to topographic surveys along our waterways and in the more densely settled parts of the country. This, of course, is our direct function, the scientific problems which may be solved from the field data secured, although very important in themselves, being of relatively secondary consequence to the economic value of a geodetic survey. Indeed we may go further and say that unless the whole civilized world had realized the great ecomomic importance of a geodetic control for detail surveys, but a fraction of the money and energy would have been expended that has been spent.

I want you to realize that our results have already been of great assistance to other departments of the Government for the control of their surveys and maps and that, as no topographic work has been done directly by the Geodetic Survey of Canada, the importance of our light is apt to be hid under the bushel of the maps of other departments.

To show the importance of our Geodetic Survey results I give you herewith a list of information which has been supplied to our Militia Department, Naval Department, Geological Survey, Geographer's Branch and others. I would point out that this information is only a fraction of what has been requested, but that owing to lack of data, and perhaps owing to the lack of coördination of administration between the various surveys, we have been unable to supply nearly all the results which have been sought. In this connection mention might be made of the Public Works Department and the Departments mentioned above which have requested much data which could not be supplied.

INFORMATION DESIRED BY VARIOUS DEPARTMENTS, ETC.

Supplied from the Geodesist's Office, Goedetic Survey.

DATE.	DESIRED BY.	INFORMATION DESIRED.	OBJECT.
Jan. 19–'11	Militia Department.	Lat. and Long. of points in Eastern Townships and Western Ontario.	Control of their *Military Sheet* maps which they were most anxious to get.
Sept. 16–'15	Militia Department.	Azimuth of Standon-St. Paul's Church. Azimuth of Standon-St. Philomene Church.	Control of Military Sheet maps.
Feb. 5–'12	Geographer's Branch.	Lat. and Long. of Bellevue, St. Armand, Owl's Head, Orford, Vankleek Hill, Plantagenet and Buckingham.	Control of their maps.
Mar. 9–'12	Geographer's Branch.	Lat. and Long. of numerous places.	Control of their Maps.
Jan. 5–'13	Geographer's Branch.	Lat. and Long. of a large number of points in Ontario and Quebec.	Control of their Maps.
May 23–'13	Geographer's Branch.	Lat. and Long. of points between Vankleek Hill and Quebec.	Control of their Maps.

DATE.	DESIRED BY.	INFORMATION DESIRED.	OBJECT.
June 8–'15	Geographer's Branch.	Lat. and Long. of a large number of points in Ontario and Quebec.	Control of their Maps.
June 15–'15	Geographer's Branch.	Description re location of Royal, Covey Hill, St. Armand, Newton, Rigaud, East and West Base (Coteau), Huntingdon, Buckingham and Stratford.	Control of their Maps.
Aug. 27–'12	Hydrographic Survey, Naval Department.	Lat. and Long. of Scarboro and points along the shore of Lake Ontario.	Control of Lake Ontario Survey.
Oct. 23–'12	Hydrographic Survey, Naval Department.	Lat. and Long. of Point Petre and West Point.	Control of Lake Ontario Survey.
Jan. 2–'13	Hydrographic Survey, Naval Department.	Azimuth of Scarboro-Clarke Azimuth of Scarboro-Uxbridge.	.Control of Lake Ontario Survey.
Jan. 14–'13	Hydrographic Survey, Naval Department.	Lat. and Long. of Haldimand, Clarke N. and Uxbridge and Directions on North Shore of Lake Ontario	Control of Lake Ontario Survey.
Mar. 3–'13	Hydrographic Survey, Naval Department.	Lat. and Long. of points between Toronto and Niagara Falls.	Control of Lake Ontario Survey.
Dec. 3–'13	Hydrographic Survey, Naval Department.	Lat. and Long. of Gibraltar Lighthouse.	Control of Lake Ontario Survey.
Dec. 9–'14	Hydrographic Survey, Naval Department.	Lat. and Long. of points around Scarboro.	Control of Lake Ontario Survey.
May 14–'15	Hydrographic Survey, Naval Department.	Lat. and Long. of points near Coteau.	Control of St. Lawrence Survey.
May 27–'15	Hydrographic Survey, Naval Department.	Lat. and Long. of Valleyfield, Coteau du Lac and St. Zotique	Control of St. Lawrence Survey.
June 10–'15	Hydrographic Survey, Naval Department.	Inverse data of line Lat. 50° Long. 60-Lat. 46, Long. 70°	

Date.	Desired By.	Information Desired.	Object.
May 9–'13	Geological Survey.	Elevation of Hefty and Canada.	Control of Topographical Work.
Nov. 3–'13	Geological Survey.	Lat. and Long. of points in Gatineau Region and Descriptions of numerous point in Quebec and Ontario.	Control of Geological Survey Mapping. Control of Geological Survey Mapping.
Jan. 20–'14	Geological Survey.	Lat. and Long. of points in Quebec and Ontario.	
Nov. 13–'14	Geological Survey.	Azimuth and Distance Observatory-King. Azimuth and Distance Observatory-Buckingham Azimuth and Distance Navan-King.	Control of Geological Survey Mapping.
April 25–'15	Geological Survey.	Lat. and Long. Observatory, King Mountain, Hull, Wakefield, Buckingham.	Control of Geological Survey Mapping.
Nov. 3–'15	Geological Survey.	Lat. and Long. of points beginning at Buckingham and Observatory and extending into the Gatineau region also Descriptions of same.	Control of Geological Survey Mapping.
Sept. 29–'14	U.S. Coast and Geodetic.	Lat. and Long. of Hereford.	
June 1–'15	U.S. Coast and Geodetic.	Descriptions of numerous stations in Quebec and Ontario and Lat. and Long of same.	Control of International Boundary Survey.
June 30–'14	Quebec Streams Commission.	Lat. and Long. of points around Lake St. Francis.	Control of their Survey
July 28–'14	Quebec Streams Commission.	Lat. and Long. of Theford, Ham, Stratford.	Control of their Survey
Jan. 15–'15	Toronto Harbour Commission.	Lat. and Long. of Gibraltar Lighthouse, Upper Canada College or any prominent spire or tower.	To adjust Harbour triangulation.
Feb. 15–'16	City Surveyor of Toronto.	Lat. and Long. of points within or on the outskirts of the city.	Control.

I would also mention the great amount of secondary and tertiary triangulation along the International Boundary, from the Arctic Ocean to the Atlantic, which has been checked up at certain points by the results of our Geodetic Survey and the U. S. Coast and Geodetic Survey. This work has been done under the direction of the Boundary Commissioners of Canada and United States, both of whom were until two years ago the superintendents of the geodetic surveys of their respective countries, so that it is not surprising that the importance of triangulation control was recognized by them and formed a vital part of these surveys.

Nor must we forget that important branch of the Geodetic Survey of Canada, the precise levelling branch, the work of which bears the same relation to ordinary levelling with respect to accuracy which a geodetic survey bears to ordinary surveying. This branch establishes the elevation above mean sea level of thousands of points scattered over our Dominion and gives the data whereby all elevations on subsequent surveys may be reduced to the same datum.

It is a matter of great satisfaction to state that the level lines were this year completed from the Atlantic to the Pacific Ocean, the discrepency between the two oceans being about a foot. The work has been based on five different reference points as follows:—

Halifax to Moncton on the Halifax sea level datum.

Moncton to Riviere du Loup on a St. Stephen, N.B., sea level datum.

Riviére du Loup to Port Arthur on a U.S. bench mark at Rouse Point, New York.

Port Arthur to Kamloops, B.C., on a U.S. bench mark at Stephen, Minn.

Kamloops to Vancouver on a Vancouver sea level datum.

The number of miles of levelling since the beginning of the work in 1907 is distributed among the provinces as follows:—

Ontario	3282	miles.
Quebec	1249	"
Alberta	1185	"
British Columbia	1046	"
Saskatchewan	928	"
New Brunswick	864	"
Nova Scotia	705	"
Manitoba	431	"
Minnesota, U.S.A	89	"
Total	9779	miles.

This is exclusive of 491 miles pf precise levelling in the Yukon in connection with the International Boundary Surveys.

The total number of standard bench marks established since the beginning of the survey is 2813, which number does not include those bench marks of other organizations whose elevations have been found by our levelling.

At the 1914 meeting of this Association, in a talk entitled "Geodetic Results and Their Practical Meaning," Mr. W. M. Tobey, D.T.S., gave us as a fitting motto for geodesists, "Be fair to D," in which D represented a very distant position. The argument was that the greatest care must be taken and the most rigid methods used in the prosecution of a geodetic survey in order that errors, minute in themselves, would not produce large discrepancies when carried across the country through a triangulation to the position D. After the field data are secured a full investigation of the errors must be made, and these errors and discrepancies must be carefully placed in their most probable position in the triangulation. Then, and only then, can the final computations of geographical locations be started.

Now you or I, without taking much thought to the principles involved, would readily undertake to throw a bridge across a narrow ditch, but when the erection of a stupendous structure such as the Quebec Bridge is undertaken, it has been brought home to us in the most terrible manner that the effect of the most varied forces must be fully known and must be correctly allowed for in the successful prosecution of such a huge scheme. The awful disasters which have attended the erection of our Quebec Bridge bring home to us with shocking directness the necessity of giving attention to the small and apparently insignificant forces, the neglect to properly apply some of which has led to such formidable loss of life and money.

Although I do not propose to enter into the details of many of the forces which tend to cause trouble in the successful prosecution of a geodetic survey, I wish to point out the analogy between the cases of the large bridge and a geodetic survey as showing the need of the greatest care and the fullest knowledge of the underlying principles of mathematics and geodesy, that comparative disaster may not crown the geodesist's efforts and in order that we may "be fair to D."

Let us refer to the subject of the datum on which a geodetic survey will rest. A definition of what is meant by a datum in this sense must be given. After the errors of observation have been adjusted and in making computations through a triangulation system for the latitude and longitude of stations and the azimuth of lines, we must commence with a station whose coördinates are known and base our computations on certain dimensions for our spheroidal shaped earth. Then the datum for the coördinates throughout that system of triangulation is the geographical position of that system on the particular earth which we assume as being the correct one and is defined by the coördinates of the station from which the computations started.

Now you will say that this problem is quite simple, that all we need is to make observations at our starting point for latitude longitude and azimuth. Let us just take the case of the big bridge and see if we cannot find an analogy to the present case. Suppose we had no levelling instruments for obtaining the levels at the different piers. We would then probably make an assumption that bed rock was level and that, by starting to build our piers all from bed rock, the tops of the piers would all be at the required levels, and the bridge would all fit together point to point. It is unnecessary to state that the bridge would evidently be very uneven, to say the least.

Now similar results would ensue if we based our geodetic survey on the datum defined by astronomical observations at one station. These astronomical results are subject to errors which may be many times the errors of observation, due to the deviation of the plumb line at the points of observation caused by the attraction of unequally distributed densities, as typified by mountains and lakes or valleys. Hence the coördinates of triangulation systems based on these erroneous observations would seriously clash at their points of junction and it would be impossible to follow our motto of "being fair to D."

Perhaps one of the most familiar examples of the analogy between our suppositious uneven bridge and a survey based on astronomical observations alone is given by the well known crookedness of the 49th parallel boundary between Canada and United States or the 45th parallel boundary on the south side of Quebec Province. These boundaries were both located by astronomical observations for latitude and are both badly bent at certain points due to the attraction of mountain masses in the vicinity of the lines—at certain points the located line is quarter of a mile or more from the desired position.

You may ask why a certain datum cannot be selected and used for the coördination of points all over the country. What does an error of a few feet matter when we cannot plot distances smaller than miles on our maps? The answer is quite simple. "Be fair to D." Just as well ask a surveyor to begin work with a chain of erroneous length, or tell him his survey may start at a point *anywhere close* to a momument, or start him on his survey with an erroneous azimuth.

Do you ask how a reliable datum is to be obtained, how a mean level of bed rock is to be fixed for the building of our bridge so that it may be made even? In the case of our bridge it is only to be obtained by taking very careful levels between our different piers and taking a mean of the different bed rock levels; the more piers we have, the more accurate will be the mean level of bed rock obtained. With our geodetic survey we must connect our many astronomical stations by triangulation, the most accurate method known for obtaining the relative positions of points. The greater the number of astronomical points connected by triangulation the nearer perfect is our resulting datum. Do you now realize why perhaps 25 years may elapse before a final datum can be selected and why published positions may have to be changed?

Very luckily for us in Canada we have a number of points at which we may start the construction of our huge bridge. Very kind was the United States Coast and Geodetic Survey when it said, "We also have a huge bridge already built right alongside of the site of your bridge. Our bridge may be somewhat imperfect in places and our mean bed rock datum may be slightly in error, but it is based on astronomical observations at some 600 points scattered over our country and is better than you can get for a long, long time. There are also a number of places at which our bridge almost touches the site of your bridge. Why not make use of our work? Why not save the money and delay required to get your own bed rock datum? We are sure that finally it will be found that your bridge will almost exactly meet ours where they touch, when you have finished twisting it around and jacking it to and fro. Why go to the expense of jacking it up here and there for 30 or 40 years to come? Let's make a great big bridge together over the whole continent, making use of the outlying points of our work from which to start building yours and to which you can make yours fit. Mexico is also building a bridge and is using our bridge datum. Let's all use it and call it the North American Datum."

The late Dr. W. F. King, then Superintendent of the Geodetic Survey of Canada, examined the United States bridge, considered its weaknesses and strength, saw that certain points where it would touch our Canadian bridge were soundly built and on the firm foundation of the United States datum, and very wisely and sensibly, we feel, in 1913 accepted the North American Datum as the basis for our Canadian triangulation, thus saving much time and money to this country in having the question of the datum settled once and for all and avoiding clashes between the results of the work of the two countries.

A number of the questions which demand the attention of the geodesist might be stated here. As this would be largely a repetition of the points of Mr. Tobey's paper on "Geodetic Results and their Practical Application" above referred to, I will simply call this paper to your attention and request its study.

There is one source of error in triangulation systems, however, to which a few words may be devoted. That is the error due to "twist." This error, as its name implies, is a gradual deflection of a scheme of triangulation from its true position due to certain unknown causes. In the case of our huge bridge it is as if certain members on one side were too long, with the result that, at our piers, the bridge would be to one side or the other of its true position. In a triangulation system this twist is noticed, for example, where the triangulation schemes along two meridans are joined by a cross line of triangulation along a parallel of latitude. In such a case it is often found that the systems along the meridians have approached or receded from one another by an amount which cannot be accounted for by the known errors of the triangulation.

Now you will easily see that the measuring of a base line will not remove this error, as the measurement of a base merely controls the scale of our triangulation but not its lateral motion or "twist."

Nor could astronomical observations control the positions of our end points, as they are subject to errors due to the deflection of the plumb line possibly many times the errors of either twist or scale.

To give an example of how much this "twist" may amount to, one case in the Boundary Survey secondary triangulation on the western 49th parallel may be cited. Here a twist of 43 seconds in azimuth was found when the triangulation had progressed some 200 miles. Errors as large as the above would not be found in primary triangulation, but when it is said that the mean discrepancy between geodetic and astronomic results in azimuth at 24 primary stations in California was over 11 seconds it will be seen that azimuth observations must be used with circumspection in checking up a geodetic azimuth at a station.

This error of twist is happily removable from triangulation in the adjustment of errors by means of a simple relation, called Laplace's equation, that exists between azimuths and longitudes

$$\alpha_A - \alpha_G = -(\lambda_A - \lambda_G) \sin \phi$$

where α_A and α_G are the astronomic and geodetic azimuths at a station.

λ_A and λ_G are the astronomic and geodetic longitudes at a station.

ϕ is the latitude of the station.

The discrepancy between the two sides of the above equation gives the twist of the triangulation system.

In speaking of the errors in astronomical results due to the deflection of the plumb line a few words may not come amiss. The effect of this force is comparable in its sinister influence on astronomical observations to the effect of horizontal refraction on the refined measurement of horizontal angles. We may give cases of its appearance and its causes and we may to some extent predict its sign if we know the character of the surrounding topography, but it is very apt to steal on us like a thief in the night when we least expect it. Because this thief has not visited the house next door we may not argue that our house will be immune from his depredations, nor can we assume that our house will be left untouched because the surroundings seem to be such as not to tempt the thief.

The cause of this deflection of the plumb line is due to the attraction of unsymmetrically distributed masses of matter. Thus on the north side of a mountain range the plumb line will be deflected towards the south, our northern horizon will be depressed and the altitude of the pole or the latitude of our station is increased. By analagous reasoning longitude and azimuth results are affected by the same cause. We cannot, however, assume that, because our astronomical station lies on a level plain, our results will be free from errors due to this influence. Such an assumption was made in India and a great deal of geodetic computation was based on the astronomic observations made at a certain station. It was later found that all these positions were greatly in error and it was concluded that some sub-surface mass of great density existed which deflected the plumb line in the whole region. Nor can we assume that because no deviation of the plumb line exists at one point, no errors will be encountered a short distance away—say 100 miles. A case is on record on the south side of Lake Ontario where differences in the deflection of the plumb line of 12 seconds in latitude (1200 feet) and 9 seconds of arc in longitude (600 feet) were found between stations only 80 miles apart.

I would like to have had time to tell you how these deflections may be partly computed and how the discrepancies between astronomic and geodetic coördinates may be used in the determination of the figure and dimensions of the earth and in corroborating theories regarding sub-surface densities. There is, however, insufficient time today, but perhaps what has been mentioned will give some idea of the enthralling nature of geodetic work and the problems which arise in its prosecution.

In closing, permit me to again remind you of the stand taken as long ago as 1888 by the Dominion Land Surveyors Association on the necessity for geodetic surveys in our country. At this critical period of our Dominion's history, with the benumbing influences of a great war and the coincident loss of our esteemed Superintendent, Dr. W. F. King, the Geodetic Survey of Canada feels a crying need for a strong man at its head and for a broad basis of organization that, no matter what the exigencies of the present moment, it may continue later to fill its proper function —being fair to D—in the economic development of our country. If what has been said will remind you of the tremendous necessity for and the great economic value of a zealous prosecution of a geodetic surveys in our country, the speaker will feel that his time has been well spent.

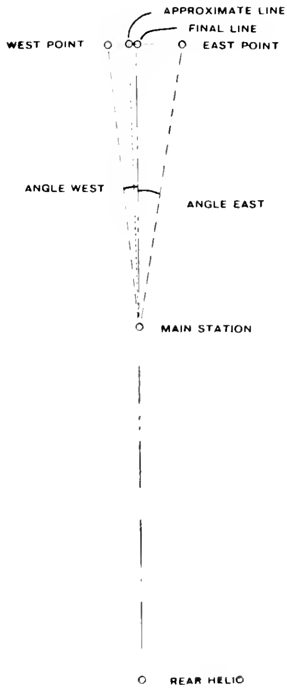
The Chairman.—I am sure that we have all listened with great interest and pleasure to this paper of Mr. Rannie. Will the gentlemen like to make a few remarks and have them put before the Association?

Dr. Deville.—Mr. President, I think I am expressing the feelings of every one present here in saying how pleased we are to hear this paper. We have been told many interesting things, and some points were brought out which are not generally known or have been given little attention. So far as I am concerned, my connection with the Geodetic Survey has consisted mostly in the receipt of objections against it by people who took it for some German scheme and asked for explanations. There was in particular a clergyman who protested against some mark that had been made on the steps of his church: he was quite indignant and held that these people should not be allowed to run thus across the country and pursue their nefarious schemes. I would like to make a motion for the presentation of a vote of thanks to Mr. Rannie for his excellent paper.

Dr. Klotz.—I have much pleasure in seconding Mr. Deville's motion of a vote of thanks to Mr. Rannie. I think we are all satisfied that Mr. Rannie knows what he is talking about and that he is not talking through his hat. I think we will all carry away with us a good opinion of what Geodetic surveying is. It is playing a very essential part in the development of Canada. I remember making a computation of the differences of latitude between two points on opposite sides of a canyon in Colorada. On account of the great void caused by the canyon there was a difference in the latitude of the place of over a mile. When you were on the North side the difference there was thrown North to South, and when you were on the South side, the difference was South to North. This is, I think, what Mr. Rannie refered to when he spoke of the effect of the deflection of the plumb line on astronomical observations.

THE CHAIRMAN.—Mr. Rannie, I am pleased to present to you the thanks of the Association for your very excellent paper. The next item of our meeting is a paper by Mr. J. D. Craig, entitled: "A few notes on the completion of the survey of the 141st meridan."

DIAGRAM ILLUSTRATING THE METHOD OF PROJECTING THE 141st MERIDIAN.



NOT TO SCALE.

Average distance between stations . . . .15 miles.

Average distance between east and west points. . . . . 1.5 meters.

THE COMPLETION OF THE SURVEY OF THE 141ST MERIDIAN.

(Illustrated).

J. D. Craig, D.L.S.

It is with considerable diffidence that I have come here this evening to attempt to tell you something further about the survey of the 141st Meridian. Mr. Lambart's paper, read at our annual meeting here five years ago, was so comprehensive and covered the subject so thoroughly up to that time that I am going to say nothing whatever about the survey of the meridian as a whole, and I want you to consider anything I may say this evening simply as an extension of Mr. Lambert's paper having particular reference to the portions of the line which were completed after his paper was written, namely, the Arctic section and the St. Elias section.

There is just one point to which I would like to refer before taking up these two extremes of the line, and that is to go rather into details as to the actual manner in which the line, as a line, was projected. I have always found in talking about the work that everyone seemed much interested in how the line was kept straight, and I have thought that perhaps a simple diagram might help to clear the matter up somewhat.

You probably remember that the point where the meridian crosses the Yukon river was ascertained by the telegraphic longitude method in 1906 by members of the staff of the Dominion Observatory and of the Coast and Geodetic Survey of Washington. At the same time the azimuth of the line was determined, and on the field staff of the Boundary Survey devolved the task of projecting this line north and south from the Yukon on its determined azimuth.

The method employed may be briefly described as an elaboration of the ordinary direct and reverse sight method of ranging out a line with a transit and pickets. For the front and rear pickets were substituted heliographs (or heliotropes as they are more properly called when they are not specially fitted with a key actuating the mirror for communication purposes). Instead of the ordinary transit, one equipped with a micrometer eyepiece was used, and communication between the rear, fore and instrument parties was maintained by means of the helios, using a modified Morse code, the instrument party using a regular British army heliograph.

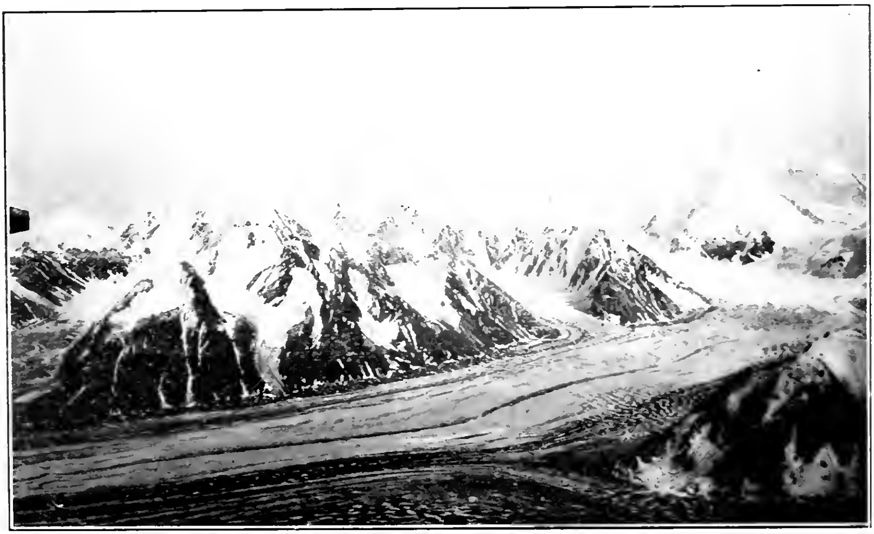
Doubtless some of you, wishing to take particular care with some line in producing it, have taken four sights instead of the regular two, *i. e.*, two each direct and reverse, instead of one of each, and have then taken on the ground what might be termed the graphic mean of the four settings of the picket. In our method there was substituted for these several settings of the picket, a number of readings of the micrometer on the fixed forward helio, the arithmetical mean of the several readings of the micrometer giving the true position of the helio.

The program was somewhat as follows: In the diagram let "Main Station" represent the instrument station and "Rear helio" the rear helio, set of course over some point on the line already established. Setting up the transit and levelling carefully, we first found, in micrometer readings, an approximate value for the collimation error of the instrument by taking direct and reverse readings on the rear helio, reversing the telescope in the standards between readings while the plates remained clamped, the mean of the two readings giving a setting for the micrometer at which the collimation error would be approximately zero. Then setting the micrometer at this theoretical value, and resetting the cross hairs on the rear helio, and transiting through, an approximate location could be given for the forward station.

We were peculiarly fortunate throughout most of our work in being able to get men for this forward helio work who had good "bumps of location" and when we had indicated about where we wanted our next station they would almost invariably turn up on time on the proper ridge and very close to the line, often uncannily so. They were almost always within the field of view of the telescope, and the first message to them would probably read something like this: "Move one hundred feet east." or west as the case might be. This first move, being carefully watched through the telescope, served as a scale by which to gauge the following moves, and usually two or three further messages would result in the helio being set on the approximate line as indicated by the micrometer set at the theoretical collimation value.

The fore helio man had instructions to then select and mark two points, one on either side of the approximate line and about 1.5 meters apart, the line joining these two points being nearly but not necessarily exactly at right angles to the line. There is a reason why these two points had to be marked immediately, for we early found that if they were not marked at once, sometimes the helio would be removed at the conclusion of the readings before the point had been marked and that meant that some hours work had to be done over again. And I can assure you that swearing at a man fifteen miles away by means of a heliograph is both exasperating and unsatisfactory.

The helio being set over one of these points, the two observers, Canadian and American, proceeded to take alternate sets of readings measuring the deflection angle to the helio, the program being



Mt. Logan (19,840 feet), Canada's highest mountain, and Mt. King (16,970 feet) in the background at the right.

as follows for each set: three on the rear helio, circle west, three on the forward helio circle west, then three on the forward helio circle east and three on the rear helio circle east, the telescope being reversed on the standards each time and the plates remaining clamped throughout a set and the instrument (a 6¼ inch Berger by the way) being carefully levelled between, never during sets, with a stride level. It was found more convenient both in recording and in computing to use the terms circle west and circle east than direct and reverse, as the latter system was apt to be at times rather ambiguous. If the means of the first three sets of each observer did not agree within 5 seconds of arc the observations were continued until the means of all the sets did agree within this limit. Each set meant twelve readings on the forward helio and twelve on the rear, so that its position and the collimation value of the instruments for that particular set finally depended on at least seventy-two readings by the observers. Although 5 seconds was the limit set by the instructions, practically the whole line was done under a 3 second limit of difference (0.9 inch to the mile).

The observers having agreed on the value of the first deflection angle and the fore helio man being so advised, the helio was removed to the second point, which was then similarly observed upon, and the means of the observations of the two observers were accepted as the values for the deflection angles. The fore helio man had meantime carefully measured the distance between the two points, and this was transmitted to the instrument party. This distance being so small (1.5 meters) and the distance between the stations so comparatively large (10 to 25 miles), a simple proportion gave the position of the true line with reference to the two forward points. Thus: one angle is to the sum of the two, as the distance from one point to the line is to the whole distance between the points. This position was then sent to the fore helio man who then measured off the distance to the true line and marked a point on it, usually by a drill hole in rock, erecting a cairn and signal over it.

A system of triangulation was carried along the line, furnishing control for the topography and checking the work of the line projection party, but while this triangulation would of course have detected any large errors in the projection, such small intermediate errors as did creep in owing to indefinite causes such as the deviation of the plumb line for instance, were absorbed in the adjustment of the triangulation to the line, and the line was considered straight.

The most economical distance between stations was found to be about fifteen miles. It was quite possible, of course under favorable circumstances, to read helio signals at much greater ditances than this, but even a 15 mile foresight and a corresponding back-sight meant that for observation and communication purposes there had to be at the same time sunlight on three points covering a stretch of thirty miles, and it was found advisable to keep this distance below thirty miles where possible, thus both saving time for the helio parties and establishing control points close enough together for the use of the following vista-cutting and stadia parties, while for greater distances than this, these parties had to do considerable independent work lining in between projection stations. Of course the nature of the topography was really the governing feature in the selection of stations, but where possible the distance was kept between fifteen and twenty miles.

With apologies for spending so much time over this question of the projection, I will now revert to the subject of the completion of the survey.

At the end of the season of 1911 the line was practically complete from the northern flanks of Mt. Natazhat, fifteen miles south of the White River, to a point about thirty-five miles south of the Arctic Ocean, and the completion of the northern end in 1912 and of the southern end in 1912 and 1913 certainly took those members of the survey who were fortunate enough to be assigned to this work, into two very interesting sections of the country.

Every surveyor of course knows the peculiar feeling of elation that comes over him when he comes suddenly perhaps over some summit and sees before him an expanse of practically unknown country. He expands his chest, takes a deep breath and says to himself, or perchance to his companions, "Well, I guess we're the first white men to see this wonderful view" or to cross this pass or whatever words happen to suit the occasion. I want to disabuse your minds at once of any idea that, at the northern end of the work, at any rate, we were in a *terra incognita* by telling you that one day about twenty-five miles from the Arctic we had crossed the British Mountains and were following north down a particularly desolate timberless valley, when there flashed through my mind some of these "no-white-man-ever-here-before" thoughts and I was beginning to feel all the usual thrills when I was brought rudely to earth by preceiving a blue and white cotton handkerchief tied to a scrubby bush, and a little further on were a couple of lengths of camp stovepipe and an empty tomato can, practically proof-positive of the previous presence of white men. It was the same practically whereever we went at the northern end. The whole country had been over-run at various times by the ubiquitous prospector, and by hunting parties procuring fresh meat for some of the numerous whalers formerly wintering at Herschell Island who depended to a considerable extent on wild meat for variety in their winter diet.

Mt. St. Elias (18,009 feet) and the snow and ice-fields north of it, as seen from a point 25 miles to the northwest.

We naturally had made attempts on our way in each year to find out from such old timers as we met, what conditions we would encounter as the work progressed northward, and a great deal of the information so collected proved to be absolutely unreliable, though it caused us a considerable amount of worry at times. It seems that the average prospector or trapper has very little idea of the needs of a survey party. For instance, we were told that it would be absolutely impossible for us to take horses more than a very few miles north of Rampart House unless we packed along all their feed, both hay and oats. We might get as far as the Old Crow Flats with them, but that would be the extreme limit, and we would then be forced to use dogs for transport—and then they promptly came forward with a bid of about $25.00 per ton per mile for moving our freight by dogs! However, we decided to try horses in 1911 anyway and we found the feed so good that we had no hesitation whatever in relying practically entirely on horses in 1912. We did attempt to have a handful or so of oats for each horse each day, but at the coast even this was out of the question and our animals there got nothing except what they could "rustle" for nearly a month, and came through in splendid condition in spite of all the hard work they were called upon to do.

Fuel too proved an agreeable surprise. It was predicted that we would not be able to find wood for fuel except comparatively close to Rampart House. On the contrary, up to within thirty-five miles of the coast we found good timber in all the valleys. North of there we always were able to find a camping spot with scrub willow more or less convenient, though sometimes it was necessary to keep two or three men gathering "fagots" almost continuously. They collected them and brought them to camp in large sacks on the horses backs. At the coast itself we found a bounteous supply of driftwood, thoughtfully put there by Mother Nature for our use, and for the use of any others happening along. Practically every little cove along the coast has its supply of driftwood, most of it coming from the Mackenzie River, and it is so plentiful that steam whalers for years have depended on it for fuel for use in these northern waters, reserving their scant supply of coal for the return trip south in the Pacific. We had taken a battery of oil stoves in with us for use in the woodless country but they were promptly discarded without ever having been used.

One of these camps in which we had to collect the fuel as mentioned, was about twenty-five miles from the coast and at an elevation of 2500 feet above sea level. In this camp one of the American Chiefs of Party was taken ill with what we diagnosed as "bronchial pneumonia"—at any rate he was very ill. You know what our fuel supply was, and while we had plenty of antiseptics, liniments, and medicines for cuts, burns and bruises, pneumonia was rather beyond us. That patient lived for nearly three weeks on egg noggs made from brandy, of which we fortunately had one bottle, and powdered eggs and powdered milk, being kept swathed meanwhile in immense hot poultices, about two feet by three feet and a couple of inches thick of corn meal porridge done up in pieces of burlap from empty oat sacks—and he lived through it and is alive and well to-day.

Naturally enough perhaps, there was considerable curiosity evinced by all hands as to just what the coast would be like. So much has been said and written about the mysterious north that everyone was on the *qui vive*, and besides, were we not fast approaching one end of our "magnus opus"? Well, the coast itself was quite ordinary and unromantic. It is low, desolate and with a mud rather than a sand beach, and between it and the hills ten to fifteen miles to the south is a strip of tundra, or deep moss and niggerheads, which was a severe test of both muscles and temper, the myriads of mosquitos making the latter particularly difficult to control. There were with us, of course, a number of men who developed into assiduous souvenir hunters and many articles were picked up and carried home and now no doubt grace curio cabinets in various parts of the country and form the foundations of many a wierd tale. Eskimo saws made out of old barrell hoops, wooden snow knives, improvised shovels, old beads, bone implements of various sorts were all picked up round the abandoned barabaras, and one man even carried home a skull found on the tundra, to make an inkstand of, he said.

Contrary to the ideas disseminated perhaps unintentionally by the old school geographies, the Eskimo does not always live in a snow hut or "igloo." His igloo corresponds more or less to the white man's tent, and is an emergency habitation for use particularly when travelling. His "barabara" or permanent home is built of turf and driftwood usually and consists of the regulation two apartments, the outside storage room and the inside living-sleeping-eating-cooking room, a low tunnel between the two, forming the entrance to the latter, and a small hole in the roof, providing, when open, light and ventilation. This, I believe, is usually kept closed except when absolutely necessary.

Incidentally we found several skeletons in various places near the coast, one group of three in particular lying as if they had been suddenly overtaken by one of the fierce winter storms which the Eskimo dread. The mirages at the coast were wonderful and awe-inspiring. Whole ranges of mountains turned upsidedown, peculiar appearances of the midnight sun, which sometimes took on

The "Goat Trail" in the Valley of Chitistone Creek, a 45° slope with a 500 foot drop at the bottom.

very odd shapes, and seemingly vast bays of the ocean covering miles of what we knew to be dry tundra. On one occasion one of the packers took a whole pack train on a trip for several hours round one of these apparent bays. Needless to say, he was not allowed to forget it for some time.

Franklin's Demarcation Point proved a great disappointment, in that it was not at all conspicuous. A long narrow sandspit only a few feet wide, reaching nearly across the mouth of Demarcation Bay, no part of it over five feet above sea level, not a vestage of vegetation of any kind, with here and there groups of abandoned barabaras. Just so that we would not forget that we had been at the Arctic we indulged in a swim, and while it was hardly summer resort bathing—the temperature was one degree below freezing as actually recorded by a thermometer—nevertheless we enjoyed it, though we did not stay in very long.

The setting of the last point to the accompaniment of appropriate ceremonies and the unfurling of the flags of the two countries marked the completion of the northern end of the work and all hands turned south with regret.

One of the really useful developements of water craft brought about by the needs of the country is the poling boat. It is 28 to 35 feet in length by 5 feet beam, and carries a good load easily. It has a "shovel nose" bow and a long straight stern, making it easily handled with a pole, and it also "tracks" (tows) easily. Up to 25 to 28 feet it is a one man boat, one man handling 1500 to 1800 lbs upstream in pretty bad water. Any of you who have tried Peterboros upstream in fast water with a load like this will appreciate the difference in the amount of labor necessary to handle it.

Coming now to the southern end of the work you will remember that it had been discontinued in 1909, the line having been carried on to the Northern flanks of the Natazhat Range. This range forms a formidable barrier to the extension of the work to the southward. Mt. Natazhat is over 13,000 feet in elevation and there are several other peaks well over the 10,000 mark. In addition to this the country immediately to the south of the range is a veritable sea of glaciated peaks, mostly over 10,000 feet in elevation and including Mt. Bear with an elevation of over 14,500 feet. So that it was deemed advisable to carry the triangulation round this range to the westward and come in to the line again further to the south, and thence on down to Mt. St. Elias. The triangulation was accordingly carried up the White River, across Skolai Pass, down the Nizina River and up the Chitina valley, from which it was extended up the Logan Glacier to locate the line-crossing and across the snowfields to connect with Mt. St. Elias. The topography was also carried northward from the Chitina valley to connect with topography brought southward by a party working in behind Mt. Natazhat, the topography thus being completed from the Arctic Ocean to Mt. St. Elias, a distance of about 640 miles. This Natazhat party reported a peculiar occurrence with reference to the toe of the Klutlan Glacier, which drains the country south and southwest of Mt. Natazhat and forms the head of the Jenerk River. The toe of the glacier in the Jenerk valley shows, in cross-section, a body of ice overlaid with a layer of volcanic ash and soil supporting a heavy growth of timber, some of it up to 10 or 12 inches in diameter.

Carrying the work through Skolai Pass and across Russell Glacier, while it did not prove particularly dangerous, furnished enough excitement to satisfy all hands. The trail led through the terminal moraine of the Russell Glacier with its masses of ice overlaid with glacial debris of all sorts, across the glacier proper, a rather novel experience for pack-horses, and thence by the trail, locally known as the "goat trail" down the Chitistone to the Nizina. This "goat trail" proved to be a rather nerve racking trip over about two miles of rock slide with a drop into a deep chasm should any of the horses chance to slip. It was so narrow that they had to be allowed to set their own pace, as any attempt to drive them might have resulted in one of the horses trying to pass the horse ahead of him, which would of course have been disastrous.

Access to the Chitina valley was had over the snow and ice in the early spring, horses being used for transport as far as possible, when they were no longer practicable, dog teams were resorted to and it was noticed that in this section of the country the dogs were hitched in pairs, six dogs to the team, not in a single string as in the Yukon with its deep snow, nor fan-fashioned as with the Eskimos on their hard northern snow and ice-fields. All these teams usually handle from 600 to 800 pounds to the team.

It was very desirable that Mt. St. Elias should if possible be occupied as a triangulation station. It of course had been "tied in" to various stations, thus giving a much desired connection between the Yukon and Southeast Alaska datums, but an actual occupation of the mountain by giving reciprocal readings would considerably strengthen the link between the two datums in addition to furnishing other valuable information.

Accordingly a sled party was despatched southward from the Logan Glacier, over the divide and across the vast snow and ice fields in an attempt to scale from the northwest the slopes of this giant of the north, which had failed all attempts at conquest until Abruzzi reached the summit in 1897.

Back-packing to the highest camp at 13,500 feet on Mt. St. Elias.

Reaching the divide between the Logan and Quintino Sella Glaciers, the chief of the party says of the country which lay ahead of him: "From our positions we were overlooking a wide valley sweeping in graceful curves southwestward towards the Pacific. From side to side it was probably twenty miles in width with a main stream flowing through it which we took to be Columbus Glacier. Many side-streams flowed into the large one and all were of ice, and anywhere one might look there was a mantle of snow whose whiteness was emphasized by the numerous black peaks that seemed just able to hold their heads above the flood of snow. Near the head of this valley was the great towering Mt. St. Elias rising nearly 11,000 feet above the valley floor. In the evening light it looked like a white ghost, and in shape it resembled a huge sea lion, head erect and facing the east. The summit is conical and about 1,000 feet higher than a shoulder which extends two miles in a westerly direction and then breaks off precipitously for 2,500 feet to a saddle connecting with the coast range of mountains."

The better part of three weeks was occupied in sledding across the fifty odd miles of snow-fields and the actual attack on the mountain began. Sledding, of course, was abandoned and back-packing resorted to. By arduous labor their camp was finally placed on a shoulder putting out to the westward from the western end of the mountain at an elevation of 13,500 feet. After waiting four days for favourable atmospheric conditions, the attempt to reach the summit was made and according to the chief of the party, "After nine hours of difficult climbing, we were within a few hundred feet of the top of the west shoulder. The way to the summit from here was a gradual slope presenting no obstacles. Four of us were feeling but slight effects from the altitude, and I am confident that we could have made the remainder of the distance if a storm such as is known only at such high altitudes had not overtaken us. At first we were loath to admit that was anything but a slight flurry and we continued to ascend. It soon became evident, however, that it would be of more than temporary duration and that even if the summit were reached instrument work would be impossible. And so at an elevation of a little over 16,000 feet we reluctantly turned back."

Unfavourable weather prevented any further attempts at reaching the summit and lack of provisions forced a return to their base, and so Mt. St. Elias remained unconquered by the boundary survey. The trip resulted, however, in much valuable information being secured, including photographs for completing the topographic maps as far as Mt. St. Elias.

Meantime another small party was making its way up the Logan Glacier and reached a point about twenty-five miles east of the line, procuring valuable photographs of a hitherto unmapped and unknown region. Mt. Logan was tied in to the triangulation scheme, as was Mt. Lucania, this latter mountain in fact being re-discovered. It had been seen in 1897 by Abruzzi from the summit of St. Elias fifty miles away and had been named by him, but it remained for the boundary survey topographers to ascertain its exact position and to finally place it on the map. It is no small mountain either, towering as it does over 17,000 feet above sea level. Mt. Bona, another mountain named by Abruzzi at the same time, was also re-discovered and tied in by the Natazhat party of the survey.

The maps covering the entire line from the Arctic Ocean to Mt. St. Elias are in thirty-eight sheets numbered consecutively from the Arctic southward, each map covering 15 minutes of latitude and about 10 minutes of longitude. The contour internal is 100 feet and the scale 1/62,500, practically one mile to the inch. They will be issued in atlas form accompanied by an index sheet and a profile of the line. I could furnish a host of statistics as to work done and results accomplished, but will only say that it kept a small army of from forty to ninety men, and from 50 to 200 horses very busy during the seven short northern seasons which were spent on the work.

In conclusion I would like to show you the new Boundary Commissioners. Dr. Tittman and Dr. King were associated for so many years on the work that it is impossible to think of any portion of it without immediately bringing them to mind. However, Dr. Tittman was forced to retire in 1915 owing to ill-health and his place was taken by one of his lieutenants, Mr. E. C. Barnard, of the United States Geological Survey, who has had many years experience on boundary work under Dr. Tittman. And in 1916 when our old friend Dr. King crossed the great divide, his mantle, as far as boundary work was concerned, fell on the shoulders of Mr. J. J. McArthur, the former Assistant Commissioner, who I am sure needs no introduction to this audience.

I thank you, ladies and gentlemaen, for your kind attention.

The Chairman.—I wish to congratulate you, Mr. Craig, upon your very instructive lecture, as well as the beautiful pictures that have been shown to us, giving us a very good and comprehensive idea, at least, of Canada's hinterland.

Mr. McArthur.—I am sure that this lecture has been a revelation to most of us. When the Commission discussed the running of the 141st meridan through this country to the North from mount

St. Elias to Mount Natazhat, judging from the views taken from the summit of Mount St. Elias by the Duke of the Abruzzi the prospects were not very encouraging. In fact, they had no hopes of getting the line through. It has been put through, though, and I think it reflects great credit on Mr. Craig and his colleague and on the men whose enthusiasm and heroism made the expedition a success. I would thank Mr. Craig for his very interesting lecture.

Dr. Klotz.—I must compliment especially Mr. Craig on some of the photographs. I do not think I have ever seen a series of photographs so beautiful. Mr. Craig's remarks about the disappointment of the party generally on reaching the Arctic Coast and finding it so uninteresting, reminds me of two or three years ago when I was in San Diego. I took the sight-seeing car, went out to Point Noma. It was several thousand feet over the Ocean and the Director of Ceremonies said: "This is the Pacific Ocean." A lady said: "I thought it was bigger." Well, I would repeat that I greatly enjoyed the beautiful photographs that Mr. Craig has shown us to-night.

Secretary Hubbell.—This lecture of Mr. Craig's has been a surprise to me. I had not the faintest idea when I asked him to give us a paper that he had such beautiful illustrations and I am sure that other surveyors were not aware of this either. and I would like to ask Mr. Craig, to give us a little description of the inhabitants of that part of the country.

Mr. Craig.—As far as the southern end is concerned, there are no inhabitants except those members of the surveying parties you have seen in the pictures. At the northern end, we did not see much of the Esquimaux. I think that two of our men did see an Esquimaux and his family. The Bishop of Yukon was having his annual round-up, as our men called it, at Fort Macpherson and the Esquimaux were all there and we did not come into contact with any of them. The two that these men did see could not talk English and they of course could not talk Esquimaux. This Esquimaux was very hospitable, and by signs he invited them in and offered them part of their food, but the boys could not eat it. He showed them the family treasures, a broken alarm clock, a Japanese trunk and other odds and ends. This was the only occassion on which we came into contact with any of them.

Moved by Mr. McArthur, seconded by Dr. Klotz, that a vote of thanks be presented to Mr. Craig for his very admirable and interesting lecture.

The Chairman.—Mr. Craig, allow me to present the very cordial thanks of this meeting for the very great treat you have given us to-night.

Mr. Craig.—Thank you, Mr. Chairman.

The Chairman.—It is about time to adjourn, I will remind the members of the Association of the meeting tomorrow. We have had very interesting meetings so far and hope to have more tomorrow. Tomorrow night our annual dinner takes place and our worthy Secretary here is prepared to sell you tickets at

Secretary Hubbell.—War prices.

The Chairman.—I wish to thank the ladies who are not members of the Association but who have come here to-night. We appreciate their presence among us and I am sure those who have not come to our meeting to-night have missed a very great treat, no matter what entertainment they may have had.

THURSDAY MORNING SESSION.

The Chairman.—Now, gentlemen, if you will come to order we will go on with the proceedings. Before calling on the first speaker, I should like first to intimate to those gentlemen who did not favour us with their company last night, that they missed a great treat, indeed one of the best lectures it has been the fortune of this Association to listen to. The first paper on our programme by Mr. Seymour, on "Dominion Land Survey Monuments."

DOMINION LAND SURVEY MONUMENTS.

By H. L. Seymour, B.A.Sc., A.M. Can. Soc. C.E., D.L.S.

Mr. Chairman and Gentlemen:—

As an introduction I am fortunate in being able to quote from a paper on the "Different Systems of Survey in Manitoba and the North-West Territories," read in 1885 before the Association of Dominion Land Surveyors by the late Dr. W. F. King, C.M.G., F.R.S.C. Before his death Dr. King was Chief Astronomer, but at the time of reading his paper was Inspector of Dominion Land Surveys. At that time Dr. O. J. Klotz, D.Sc., F.R.S.C.—and last but not least—D.T.S., now of the Dominion Observatory, was President of the Dominion Land Surveyors' Association. It is from a copy of a report of this second annual meeting—a copy carefully preserved by this first President and very kindly loaned to me by him—that the following is taken:—

"History tells us that man, in his primitive state, subsisted by hunting wild animals and fishing, and on the natural products of the earth.

"Afterwards, as population increased, game and wild fruits became scarce, and he found it necessary to domesticate certain animals, such as sheep and other cattle, so that by keeping them within his reach and protecting them from the ravages of beasts of prey, he might always be assured of his sustenance. He was still a nomad, as he was still obliged continually to drive his herds where the best pasturage and water could be obtained.

"As population increased, and flocks and herds multiplied, it became necessary for each cattle owner to restrict himself to a particular holding, where he would not interfere with his neighbors. These holdings, no doubt, were governed in the first place by natural boundaries such as creeks, rivers, mountains, and so forth. In support of this contention, I may refer you to Chapter 15 of the Book of Joshua, in which the boundaries of the lot of Judah are very particularly described, showing that this was the system practised by the Israelites at a time when they seem to have made some advance in civilization. The holdings being thus restricted in area, the pressure of dry seasons, in diminishing the pasturage and therefore hindering the natural increase of the flocks, upon which the inhabitants depended for their food, would be severely felt. This drove them to tilling the ground as a supplementary means of subsistence.

"It does not appear, however, that agriculture was carried on to any great extent among Eastern nations at the dawn of history, except in countries such as Egypt, where the fertile belt on each side of the Nile at once attracted and supported a large population who lived by husbandry. We read in the book of Genesis, that during a season of famine, Jacob sent his sons to Egypt to buy corn, showing that even at that early date Egypt must have been an agricultural country.

"A large agricultural population crowded into a small space, required the sub-division of the country into small holdings, which had to be determined by means of lines instead of natural boundaries.

"The science of geometry, which is the foundation of all surveying, is said to have taken its inception here, where every year landmarks swept away by the inundations of the Nile had to be re-established."

The causes that naturally lead up to the use of what are now termed in this new world survey monuments are thus briefly but clearly traced.

The terms boundary and landmark occur in the quoted portion of Dr. King's paper. Other words of a somewhat similar character will be used, and to prevent any confusion as to the meaning of these terms it might be well to define them as precisely as possible.

Boundary—The Imperial Dictionary gives as the real sense of such a term "a *visible mark* defining a limit." A distinction is made between *bound*, which may be only an imaginary line or limit, and *boundary* thus:—

"The *bounds* of a parish are defined by certain marks or *boundaries*, such as heaps of stones, dikes, hedges, ditches, rivers, streams, rivulets, etc". The terms bound and boundary are often confused. I must admit that in my mind there was never any distinction until I found that the abbreviation I. B. so often seen in surveyors' notes at a township corner might not stand for iron bar but for iron boundary. The first Manual of Survey of Dominion Lands, published in 1871, has several sections devoted to Iron Boundaries which term I have seen, not abbreviated, but in full in the field notes of a survey of ancient accomplishment. Undoubtedly, however, the term boundary is now most frequently used, especially in connection with surveying, as synonomous with bound or limit rather than with the meaning of a visible mark defining a limit.

Landmark, according to the Imperial Dictionary, is "a mark to designate the boundary of land; any mark or fixed object, as a marked tree, a stone, a ditch or a heap of stones, by which the limits of a farm, a town or other portion of territory may be known or preserved." Evidently a landmark may be of natural or artificial origin, or a natural object in its natural position but artificially marked.

Monument, is a word derived from the Latin moneo, to remind, to warn. In the Imperial Dictionary a definition is given as "something built or erected in memory of events, actions or persons," but with no meaning as applied to surveying. The American Standard Dictionary, on the contrary, gives as the meaning of the word monument as used in surveying:—"A stone, or other permanent mark serving to indicate an angle, station or boundary." We may presume from its absence in the Imperial Dictionary that the term monument in a surveying connection is an American term and is not in use in the Old Country where, in fact, what we regard as survey monuments are, I believe, very little used. Their place is taken by various land marks and natural boundaries, which physical features are accurately located and shown on the ordnance topographical maps (scale 1 to 2500).

Previous to the 1903 edition of the Manual of Survey the sections devoted to such matters were headed "Boundary Corners." In the 1903 edition, the term monument is first used, and such sections headed "Boundary Monuments." With the meaning of "boundary" as used in the old expression "iron boundary," "Boundary Monument" becomes a fine example of tautology, a literal translation being mark, mark, which sounds, as all surveyors will realize, like a rear chainman stuttering.

In the later D.L.S. monuments we have got much nearer to the root meaning of the word—to remind or warn—and on the bronze cap of the latest survey post is writ large the *warning*, "Seven years imprisonment for removal."

It is not necessary to point out to surveyors the importance of survey monuments. In the Bible a special curse is pronounced against the man who shall remove his neighbor's landmark. A special curse is still pronounced (by surveyors) against the man who has removed any landmark, particularly if it be in the form of a post.

From early Old World history, as given us by Dr. King, lack of time and, to be frank, lack of information also, forces me to jump to early New World history in tracing further the development of survey monuments and particularly D.L.S. monuments. In the year 1785, provision was made for the "locating and disposing of lands in the western territory" in the United States. Congress passed an ordinance in that year providing for townships 6 miles square, containing 36 sections of 1 mile squares. This was the commencement of the present system of survey of the public lands of our neighbor to the south.

The territory of Rupert's Land was, shortly after confederation, acquired by the Dominion of Canada and it became necessary to make provision for the survey of these Dominion Lands. In 1871, Lieutenant Colonel J. S. Dennis, a Provincial Land Surveyor, was appointed Surveyor General of the new Dominion Lands. One of his first acts was to have prepared a Manuel of Survey which was issued in this same year. He carried on considerable correspondence in connection with the system of survey as practised in the public lands of the United States. This correspondence, the present Surveyor General informs me, was during the Northwest rebellion in the possession of Louis Riel whose little daughter scribbled on these now valuable records, which, though since were in the Surveyor General's office at Ottawa, have now unfortunately dissappeared.

The U.S. System appeared admirably suited for the western Canadian plains and was copied in many respects.

"If the country had been all wooded it is questionable if such a system would have been introduced" says Dr. O. J. Klotz, who in the early days went to Washington in connection with the system of survey to be adopted. The idea of a six mile rectangular township, with sides lying north and south and east and west, and the words section, township and range were, it is true, copied from the United States. But from a scientific and mathematical standpoint the system might almost be considered a new one. For example, it is understood that the Surveyor General of each state might designate townships by numbers that represented the order in which they were surveyed rather than being indicative of the locality in which the townships were situated.

For the system that was to operate in Western Canada, however, the advantage of continuity was early and clearly seen. The result is that now each township has a foreordained geographic position, subject of course to certain possible inaccuracies in surveying. Given the latitude and longitude of any spot the section, township and range can be mathematically determined. Such a system was made possible by Lindsay Russell, who though not Surveyor General at the time was a remarkable mathematician and scientist. This high tribute is paid by Dr. Klotz, who gives Mr. Russell further credit for his ability to recognize these qualities in another man, whom he brought into the services of the Dominion Government and who later was to become, and who is, Surveyor General of the Dominion Lands, namely, Dr. E. G. D. Deville, I.S.O., D.T.S.

In the U.S. manual, published in 1871, the monuments that were to be used are illustrated. With but one or two exceptions the same kind of monuments were adopted at that date in defining the limits of Dominion Lands. One particular change, however, must be mentioned and that was the omission of the "deposit" from below the post. The U.S. manual referred to, states in relation to these and similar "mound memorials":—"Besides the charcoal marked stone, or charred stake, one or the other of which must be lodged in the earth at the point of the corner, the deputy surveyor is recommended to plant midway between each pit and the trench, seeds of some tree (those of fruit trees adapted to the climate being always to be preferred), so that, in course of time, should such take root, a small clump of trees may possibly hereafter note the place of the corner. The fact of planting such seed, and the kind thereof, are matters to be truthfully noted in the field book."

The practice of burying pieces of crockery or other objects of a distinguishable nature, is quite a common one, I understand, for the provinces of Ontario and particularly Quebec, but it has never been included in the instructions to Dominion Land Surveyors.

Buffalo horns, ploughshares and other objects were also frequently buried in the surveys made in the United States. The following synopsis of a "true" story, published in the *Engineering News*, will illustrate this as well as show to what degree of accuracy the early surveys were carried out:—Called on to locate a certain corner that had been established many years before, a surveyor of repute found that his nearest known starting point was some eleven miles away. The survey party commenced operations with every care and at last, according to calculations, the desired corner was reached. The picket was jammed down into the earth with the expectation of coming in contact with the "deposit" but nothing seemed to be encountered. What could be wrong? The surveyor commenced to carefully check his calculations, but soon gave a joyous shout. The old notes explained that in the absence of other suitable material, a grindstone had been buried. The picket had gone right through the hole in the grindstone.".

After 1871 the further development of the D.L.S. monument was apparently entirely uninfluenced by the United States practice until, as will be later explained, very recently. An inspection of the U.S. Manual of 1881 shows that the mounds were to approximate a hemisphere in shape but D.L.S. monuments have always been erected either in the shape of a rectangular pyramid or in some cases in the shape of a cone. The 2″ reference stake, marked with the section, township, etc., and driven in one of the pits was another idea not adopted in Canada, where the post at the actual corner was to be marked, wooden posts by means of a scribing iron, iron bars and stones with a cold chisel. The use of iron bars was not called for in the United States at that time.

The history of the D.L.S. monuments is the history of an endeavour, with the importance of such monuments being fully recognized, to provide by the use of artificial and natural means a permanent monument. The difficulties in the way of what now seems to be the final accomplishment of that laudable endeavour were the large number of monuments to be erected and the large areas, often difficult to reach, to be delimited by such monuments. The cost of material and the cost of transportation were consequently such important factors, as compared with the low land values, that they may be considered to have been largely the controlling factors in determining the kind of monuments to be erected in the early days of the Canadian northwest settlement.

In general, official survey monuments have consisted of one, or a combination of several, of the following: Wooden post, iron post, earth mound, stone mound, pits (or trench in the case of most witness monuments).

As each new edition of the Manual of Instructions for the survey of Dominion Lands was issued by the Surveyor General, various changes, more or less important, relative to each component part, or to the character of the monument as a whole, were called for. As an example, the case of witness mounds might be cited. Bearing trees alone or an ordinary mound and pits not necessarily on a surveyed line were at one time permitted. Subsequently wooden, and then iron, posts in connection with witness mounds have occupied positions in the centre and at the edge of the mound and in the trench of varying width surrounding the mound.

But of general importance is the relation of the post, which generally marked the corner, to the mound and pits which frequently referenced it. In such a monument the relative importance of the component parts are probably post, pits, mound. But experience has shown that post and then the mound (or vice versa) frequently disappear leaving only, after some years, traces of pits to reference the corner. Unfortunately, the mound and pits did not in the past always occupy a constant relation to the post, and when traces of pits or any other part of an obliterated monument (except the post) are found, doubt of the true position of the corner (within several feet) can in some cases only be dispelled by finding the date of the original survey and further knowing what instructions were issued to govern the erection of monuments at that date.

Within the last year or so, on the official plans of townships now issued, sufficient information is given to show at what date a monument was erected or restored. If it is known what a surveyor's instructions were at that date, and if it be assumed that the surveyor followed those instructions, then it becomes much easier, having a knowledge of what is expected, to find an old monument. Further, it becomes possible to locate the exact corner, if but traces of the old monument are found.

The importance of having exact information in regard to D.L.S. monuments has in the past, no doubt, appealed to many surveyors, but such information was not readily available, as it existed only in the old manuals, of which very few are now to be had, and in the old departmental reports.

It remained for Mr. E. H. Phillips, D.L.S., S.L.S., acting Chief Surveyor to the Lands Title Office at Regina, to have prepared a tracing of all the illustrations of monuments shown in the various editions, up to the 1913 edition inclusive, of the Manual of Survey. From this tracing, booklets of blueprints have been prepared and were issued in 1915 to surveyors in Saskatchewan.

For surveyors making lot subdivision surveys, or any other surveys that depend on the position of monuments placed years ago, such a booklet is invaluable. All praise should be given to Mr. Phillips who possessed the initiative, when the opportunity afforded, to make such a compilation.

At about the time Mr. Phillips was engaged in preparing information in regard to monuments in pictorial form, Mr. E. M. Dennis, B.Sc., D.L.S., of the Topographical Surveys Branch, was writing a paper on "The History of the System of Dominion Land Surveys" which was read at the last meeting of the Association, in 1915, and which has proved to be a most valuable work of reference. From this History there has been abstracted all that relates to monuments and such matter will appear as Appendix I to this paper when printed.

When Mr. Phillips, in 1915, sent his booklet of illustrations to the Surveyor General to be proof read, I was fortunate in being detailed to this work, and while engaged thereon, I compiled a schedule (which was checked by Mr. W. B. Armstrong, of the Topographical Surveys Branch) of the various D.L.S. monuments that were, according to instructions, to be erected.

The classification made was according to the character or nature of the monuments. Mr. W. D. McClennan, of the same staff, has since rearranged this schedule, still with the character of monuments as a basis of classification, but as far as possible in chronological order. Information in regard to the new model iron post, adopted in 1915, has also been included. In Appendix II* will be found this schedule, illustrated largely from cuts reproduced from

*It is expected that the information that was to appear in Appendix II will be shortly published and issued to surveyors in pamphlet form convenient for field use. It has therefore been decided not to include Appendix II in this report.

the tracing prepared under Mr. Phillips' direction and kindly loaned by him to the Topographical Surveys Branch. The information for the schedule was found in the annual reports of the Surveyor General for the years 1882, 1886 and 1908 and from the different editions of the Manual of Survey published in the years 1871, 1881, 1883, 1890 (preliminary 4th edition), 1892, 1903, 1905, 1910 and 1913, making eight editions to date.

There can of course, be no guarantee that the surveyor has always closely followed his instructions. In some cases the surveyor's field book shows that he did not. Further, monuments on the ground were sometimes not as shown in his notes.

According to instructions issued to surveyors, iron posts at township corners (since 1881 instructions have called for iron posts at all township corners) were, when mounds were erected, never to be placed in the centres of the mounds (except in the case of stone mounds erected since 1913, where posts could not be driven) but at the northerly angle thereof, except on correction lines, the lines between different systems of survey, the outer limits of the roads around Indian reserves, and generally all lines the posts on which marked the boundaries of lands on one side only of the line, in which cases the post was to be placed in the centre of one side of the base of the mound. Up to 1915, in which year some posts were still placed as above described, no change was made in the instructions in this regard.

Iron posts with tins on which were marked the numbers of the sections were placed in the centres of the mounds at section corners on the prairie from 1882 to 1889. Instructions issued for the season of 1887 were to the effect that no more earth mounds, but pits only, were to be erected on the prairie; the practice of erecting earth mounds was not, however, entirely discontinued for some time. The manual issued in 1890 called for iron posts and pits only at section corners on the prairie.

In wooded country no mounds or iron posts except for township corners were called for by instructions until 1890. After that date the instructions for the positions of iron posts at section corners with respect to the mounds were similar to those mentioned above for township corners.

Up to 1881, where wooden posts and mounds were used, the instructions called for the posts to be placed in the centres of the mounds. From 1882 to 1889, wooden posts were to be used at quarter section corners only, and where used in connection with mounds were to be placed in the centres. From 1890 to 1908 inclusive, wooden posts were still used at quarter section corners only, alone until 1903, but since 1903 were to be placed in the same relation to the mounds when erected, as in the case of iron posts at township or section corners. Since 1908 no wooden posts have been used except in muskegs, sloughs or shallow lakes, and now their use is to be entirely discontinued.

The directions now given surveyors for the establishment of monuments of original surveys have been in force since about the middle of the season of 1915. Prior to that date it was the practice to have a mound, when erected, occupy a position midway between the four pits, in which case a post planted at the northerly angle of the mound was *not* in the desirable position of midway between the pits, formerly the most permanent part of the monument.

A boundary monument now generally consists of a standard survey post placed with its bronze cap flush with the ground. It is planted midway between four pits or in the centre of a circular trench with or without a mound.

The standard survey post, weighing seven to eight pounds, consists of a piece of one inch iron pipe, 30 inches in length, filled with concrete. A malleable iron foot plate 3½ inches in diameter, and a bronze cap 2½ inches in diameter, are fastened to the bottom and top of the post respectively. By such an arrangement, and due to the fact that the cap is flush with the ground, the chance of the post being removed or displaced is very small, indeed.

A pit is still to be made three feet square and eighteen inches deep, and as in the past, when pits only were dug, the nearest edge of the pit is to be 5½ feet from the post.

When, however, a mound is now erected it generally occupies a position such that its centre is about ten feet due south from the post marking the corner. For any corner the mound is to be made five feet square, as has been the case in the past for section and quarter section monuments, but mounds at township corners were formerly made six feet square.

There is now, for the first time in the history of D.L.S. monuments, no difference whatever in the character of the monuments marking township, section or quarter section corner. Legally it is understood no distinction is made between a quarter section corner or a township corner; each is equally important. It is fitting, therefore, that monuments marking different corners should differ only as to the markings on the posts and not as to their general character.

Such is a brief synopsis of the various changes that have occured in D.L.S. monuments. Full and complete information, it is hoped, will be found in Appendices I and II.

Of more interest, undoubtedly, are the causes that led up to these changes. These frequently are not a matter of record but I have tried to gather, from the surveyors acquainted with our old surveys, something in this connection.

Besides Dr. Deville and Dr. Klotz, to whom I have already referred, Mr. J. J. McArthur, International Boundary Commissioner, Mr. Thos. Fawcett, of the Geodetic Survey, and Major Hubbell, Chief Inspector of Dominion Land Surveys, were other surveyors to kindly supply me with interesting information, which I will try to translate to you. Mention in this connection should also be made of the information in regard to monuments contained in the Surveyor General's Annual Report of 1891. This information appears in "A Short History of the Surveys made under the Dominion Lands System 1869 to 1889." prepared by Mr. J. S. Dennis, D.T.S., at that time chief Inspector of Surveys. Mr. Dennis has now just been elected to the presidency of the Canadian Society of Civil Engineers, a high honour. He spoke at the engineer's luncheon to-day and will honour and favour us to-night at our D.L.S. banquet. For the sake of continuity I will not refer specifically in each case to my source of information in what is to follow.

Wooden posts so readily obtainable in bush were not monuments of a permanent character. They were easily removed, were readily destroyed by fire and most of them being of poplar soon decayed. Wooden posts planted in the winter are generally placed but a few inches in the ground. They naturally fell down in the spring and soon had no definite relation to the corners they were intended to mark. But, Mr. Chairman, in the bush they were very cheap. For the prairie, however, the difficulty of obtaining and transporting wooden posts soon became a serious one. Iron posts were therefore suggested for the prairie. Dr. Deville explains how Sir John A. McDonald, the then Minister of the Interior, resisted any change in monuments that would envolve expense. The iron posts would cost the Government 25 to 40 cents a piece. If it was a convenience for the surveyors to use iron posts instead of wooden posts, why let them pay for it. The fact that wooden posts were not permanent and easily destroyed by fire were matters that did not matter. With land so cheap it was difficult to combat such an attitude. There must evidently be some relation fixed between land values and surveying costs, by which the latter is not out of due porportion with the former.

But in 1882 iron posts or tubes ½ inch in diameter were to be used at section corners on the prairie. On the top a square tin plate bearing the appropriate markings stamped on it were slipped over the post and held on by a nail through the post. Such an iron post was driven but a foot into the ground and surrounded with a mound and pits. Can anyone imagine anything more unsuitable for conditions in the prairie as they proved to be ? In the grazing country the cattle tramped down the mound, filling the pits. Both tin plate and post were easily removed either separately or collectively. Some surveyors bent over the tops of the posts to aid in keeping the tins on. But the tins made a splendid necklace or other special mark for the Indians. Major Hubbell also found on one occasion 41 tins on one iron post which had been removed and planted at a quarter section mound. I understand that the cowboys and the Mormon settlers were offenders in this respect, removing or altering the position of iron posts. Both had their reasons for not desiring further settlement. In 1886 it was decided to dispense with mounds on the prairie and in 1889 to discard the tins. The larger iron posts used after 1889 were a subject of complaint by the half-breeds who could not so readily bend or adapt them to various *useful* purposes.

Dr. Deville says that it was not expected that the tin plate would be a permanent mark, but it was thought that it would remain long enough for settlement. The marking was very clear but, as explained, the tin seldom remained. Consequently the more permanent, if more difficult to understand, chiselled mark on the iron post had to be depended on.

It was not until 1890 that iron posts were used at section corners in the bush. In 1892 a farmer at his fence corner accosted a survey party engaged on a retracement survey:—"Looking for anything boys?—Was it a post?—Wal, I have two of them up to the house?" He had taken them up for safe keeping, one section and one quarter section post. Major Hubbell reports that the farmer brought out the wooden posts in good condition.

The U.S. Manual issued in 1871 states in regard to earth mounds:—"Mounds are to be *covered* with sod, grass side up, where sod is to be had; but in forming a mound, sod is NEVER to be wrought up with the earth, because sod decays, and in the process of decomposition it will cause the mound to become porous, and therefore liable to premature destruction." A later issue of the U.S. Manual deals also with mounds of stones covered with earth. There was nothing in the first D.L.S. Manual to prohibit the use of sods, but according to the 1881 Manual, sods and all foreign substances were to be excluded from earth mounds, which were known to have consisted of a few buffalo bones with a shovelful of earth for good measure and with pits about one foot square. Many "foreign" substances are evidently out of place in an earth mound, but should sods have been blacklisted? The opinion implied in the old U.S. Manual is that the sods on the outside of a mound are an advantage.

Mr. Fawcett states that sodded mounds are still seen on the prairie, while mounds of earth only, though of later construction, have disappeared. Apparently cattle did not interfere as much with the more natural looking sod mound. Breed and Homer, on "The Principles and Practice of Surveying" state in regard to mounds:—"Mounds of this kind are of much greater value than might be supposed, for, although the sharp outlines are quickly worn away, the grass sod soon covers the mound and grows down into the pits and preserves them from entire obliteration.?" A well sodded mound no doubt weathered much better than a mound of loose soil.

Year by year the endeavour is to make the information gathered on surveys of Dominion lands more complete. Latterly there may be mentioned the much more detailed information collected in regard to the timber in a township, the levels taken on certain section lines, and I believe that a greater endeavour is to be made to determine and record topography. For years, however, the nature of the soil learned when digging pits has been a matter of record. Such information was first obtained by Dr. Klotz when surveying in 1880 in the Touchwood Hills. It was at his suggestion that the practice was regularly carried out thereafter.

Since the first Manual was issued in 1871, there was no really radical change made in monuments till 1915. Mounds at one time erected only on the prairie were more latterly to be erected only in the bush, but the mound itself has altered but little in shape or size. Wooden posts have gradually been replaced by iron posts at all corners. I understand that when in 1908, iron posts were used for the first time at quarter section corners, the old question of cost was again raised in the House of Commons. But none of these changes can compare with the use of an almostly entirely new kind of post, so fashioned and so planted that it is apparently the last word in permanence, having regard to the large number that have to be planted and the distance they must be transported.

The new model post is copied from the post now used on the survey of the public lands of the United States, but it is by no means an exact copy and is undoubtedly an improvement in many respects. With the Surveyor General's kind permission I am able this morning to show you the latest model. Various improvements over the 1915 and 1916 models will be noted. In this connection also note figures A., B., C. and D.

The addition of the year on the bronze cap is a valuable record of the date of the survey. All possible objections to the way witness monuments have in the past been marked, are now removed. For all information by which one can locate themselves, in a township is given and the witness information added. No longer can surveyors complain as in the old days, of walking many weary miles and finding always only witness monuments at the section corners, with the marks on the post indicative only of the direction and distance at which the corner might be expected but nothing of the section number (added in 1908) or of the township and range.

Time permits me to but mention the various suggestions that have been received from surveyors and from the special committee composed of Messrs. I. J. Steele, G. H. Watt, G. J. Lonergan and J. R. Akins, appointed at the last meeting of this Association in regard to a new post and to the best method of planting it. But are not all these suggestions of record on the files of the Department of the Interior? And is not the post as now constructed eminently satisfactory? And are not the directions for the planting of this post embodied in the ninth edition of the Manual about to be issued?

Gentlemen, there is one feature of the new monument that I do not like, and that is the continuance of the use of the mound. I believe that whatever its usefullness may have been in the past, that that usefullness has been largely outlived.

As a mark, a mound is much more necessary on the prairie than in the bush. But the reason that forced it from the prairie has been given. In 1889 it was recommended by the Inspector of Surveys, that posts and mounds should be made at all corners in woods. The post, by this change, lost its desirable position of mid-way between the pits, being placed at the northerly angle of the mound.

With two cut lines now intersecting in the bush at every section corner, it would seem that *any* corner monument should not be as difficult to find as a similar monument on the prairie. The post is probably now the most permanent part of the monument and with the pits makes a monument that any surveyor can easily find.

If the mound is to be erected for the convenience of the settler, will not its new, strange and sometime varying position in relation to post and pits prove in some instances misleading? Enquiries are still occassionally made by setlters as to whether they should take the corner or centre of the mound. Failing to locate the post, which one can imagine in some cases to be covered with earth, leaves, etc., what will some settlers now take for the corner, some point on the mound or the centre of the pits?

Its a long way from the mound to the two furthest pits, about sixteen feet in fact from centre of the mound to the centre of one of the far pits. From these pits earth must be thrown or carried with chances of spilling it on the way. The mounds erected last year

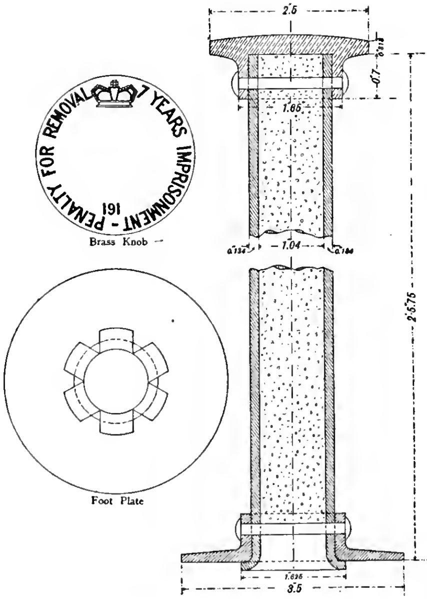


Fig. A.—Iron post for Dominion Land Surveys. 1915 Model.

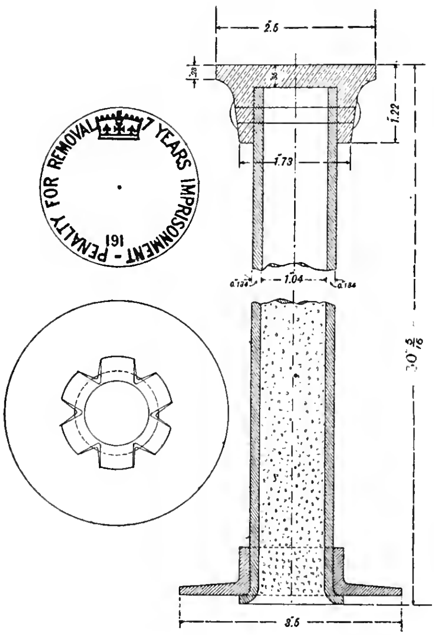


Fig. B.—Iron post for Dominion Land Surveys. 1916 Model.

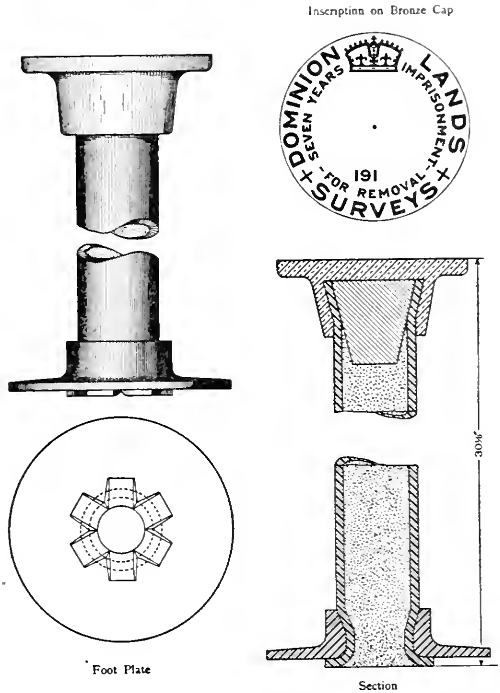


Fig. C.—Standard Survey Post. 1917 Model.

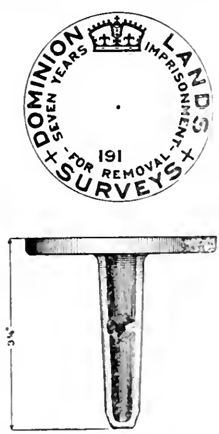


Fig. D.—Short Survey Post for planting in rock. 1917 Model.

are silent witnesses as to the difficulty of making a neat mound under the new conditions. Mr. Narraway, D.L.S., Inspector of Surveys, tells me that many of the mounds inspected were of good shape, as regards the sides nearest the pits, but the far sides of the mounds were fequently unshaped dumps. In the past it was easy to shape a mound when earth was thrown up from all sides and but little extra labour was involved. It was not only easy but convenient and got over the difficulty, suggested by a layman, of having to dig another hole in which to put the earth taken from the pits. In any event it would seem that the mere fact of mounds under certain conditions being considered necessary in the past, should not be given too great a weight when these conditions, as at present, are considerably altered. Omitting the mound might somewhat reduce the extra cost of say, at present, about $1,00 per monument over the old style.

Mr. Narraway found last season, that without exception, every post he inspected projected above the surrounding earth. He recommends that to allow for settlement of the earth, the post be in the first place planted two inches below the adjacent ground surface. He further recommends that the surveyor make it his business to inspect all monuments before leaving any particular camp. He found 60% of the mounds and pits inspected below standard,—mounds and pits that would under the contract system have caused the surveyor unwelcome reductions in his account.

The bearing tree has had a rather chequered career. In the early survey days it was always in favour being used whenever possible to help mark a corner. In fact, where no other monument could be erected a bearing tree was considered quite sufficient for a witness monument. There has always, however, been a distinction between the way a "bearing tree" and a witness monument was to be marked or its bearing from the corner recorded. From the mound to the corner in the case of a witness mound but from the corner to the tree, in the case of a bearing tree is how the bearing was taken. Then came the days (1890) when the bearing tree was not mentioned in the Manual. It came into favor again in the 1910 edition of the Manual. But the instructions for the erection of boundary monuments on Surveys of Dominion Lands issued in 1916 mentioned it not. However, according to the new edition of the Manual to be shortly issued, the bearing tree may again be used to witness the position of a monument if the tree is of a nature to form a permanent mark.

Of monuments for group settlement or river lots and for marking the limits of public highways, little need be said, except that as far as practicable they were to be erected, with but few exceptions, ike section corner monuments.

The mention of townsite posts, no doubt recalls pleasant memories of pre-war days to the surveyors who were engaged in private practice in the West. The townsite monument to be erected on surveys of Dominion Lands, was first mentioned in the 1903 Manual. It has changed from a wooden to an iron post planted, as at Banff, in a very permanent manner, but needs no special mention in this paper as the townsite monument has, I think, consisted always of but a post unreferenced by pits or mound.

But this paper would not be complete without a reference to the monuments left in 1885 by Mr. Ogilvie, D.L.S., and in 1886 by Dr. Klotz on their traverse survey of the C.P.R. in the railway belt of British Columbia. The land in B.C., which by arrangement was to come under control of the Dominion, was to be bounded by "a medley of arcs of 20 mile radius" as Dr. Klotz expresses it. It was necessary to traverse the railway as the only practicable base line from which surveys could be projected in conformity with the system of surveys in the northwest.

Dr. Klotz tabulated approximately one million figures on the long and arduous task of computing the position of every point 20 miles at right angles on each side of this traverse line. However, subsequently the Dominion and B.C. Governments compromised on section boundaries, as the limits of the railway belt, based on Dr. Klotz's calculations. The problem of erecting suitable monuments was under the conditions in the Rockies evidently a difficult one but it was solved by using telegraph poles marked C.P.T. (Canadian Pacific Traverse) and numbered with consecutive Roman numerals.

In the report of an early Presidential address by Mr. Thos. Fawcett, D.T.S., I find that in exhorting the members of the Association of Dominion Land Surveyors to present and read papers, he said "leave a *monument* behind you, that you may live in the future." Surely then a paper on *Monuments* should entitle one to live forever.

APPENDIX I.

A History of D.L.S. Monuments.*
(1871–1915).

Manual of Survey, 1871.

A sold iron bar, five feet long, was driven to within fifteen inches of the top at each corner of the block of four townships when such corner was in the prairie. These bars had ragged corners for

*Abstracted from a paper on "The History of the System of Dominion Land Surveys", read before the Association of Dominion Land Surveyors, by E. M. Dennis, B.Sc., D.L.S., in 1915.

the lower three feet to hinder them being pulled up. For all other corners whether a township, section or quarter section corner, the monuments were to be as follows:—

In timbered country if a tree was found at the precise corner it was squared and marked. If not, a wooden post was planted and the position of the corner further defined by one or more bearing trees marked "B. T." with a scribing iron. At a township corner, a five inch post was squared to three and one half inches, driven one foot into the ground and projeced thirty inches. At a section corner, a four inch post was squared to three inches, driven one foot into the ground and projected two feet. At a quarter section corner, a three inch post was flattened on two faces, driven one foot into the ground and projected eighteen inches. If a suitable stone could be readily found, it was planted and marked for the corner. In the case of a township corner, a small pyramid of stones was built beside the stone. If in timbered country, bearing trees were also marked.

In prairie country the wooden post was surrounded by a mound, six feet sqaure at a township corner and five feet square for other corners, the post showing ten inches above the mound. In the case of a quarter section corner the mound only was sufficient if wood was hard to get. These mounds were to be covered with sod, grass side up, wherever practicable. The mound at a block corner where an iron bar was driven was placed so that the bar stood at the northerly corner of it except on correction lines, when the bar stood at the middle of the north or south side of the mound according as the monument defined lands north or south of the correction line. The mounds were made from earth taken from four rectangular pits which were dug big enough to provide sufficient earth. The centres of these pits were to be two feet six inches outside and opposite the centre of the base of the mound. The lines connecting the cardinal points would pass through the angles of the post and the mound, except on correction lines where they would pass through the centres of the post and mound. When a township or section corner fell in an unfavourable spot for the planting of a post or the erection of a mound, a witness mound was established similar to a mound at a section corner. The distance from the witness monument to the true corner was recorded in the field notes. Posts at township corners, except on correction lines, were marked on each of the four faces with the township and the range number towards which the marking faced. On a correction line, a township corner post was marked on the west side with the section number west of it, on the north or south side with the township and the range number north or south of it as the case might be, and on the other two faces with "R" for road.

All section corner posts except those on a certain line were marked on each face with the section number towards which the marking faced. In addition the township and range numbers were marked on one of the faces. In the interior of a township or on the east outline this additional marking was on the south west face, but on the north outline, it was on the south east face. On a correction line, a section corner was marked on the face towards the road with "R", on the opposite face with the township and range numbers, and on the other two faces, with the adjoining section numbers. In addition on all posts the letter "W" or "E" followed the range number indicating west or east of the principle meridan.

The marking on trees and wooden posts were to be made with a scribing iron, and on iron bars and stones with a cold chisel.

In 1873 the management and control of Dominion Lands was transferred from the Department of State to the newly constituted Department of the Interior.

In 1874 an Order-in-Council was passed authorizing a special survey of base lines and meridans through the North West Territories and extending to Peace River. The positions of these bases and meridans were to be checked by means of a continuous triangulation to be carried on simultaneously over the most favourable belt of country that could be found for that purpose.

In the Surveyor General's report of 1876 mention is made of some methods adopted on the survey of base lines and meridans of the special survey to render the surveys as valuable as possible. All lines were chained twice and frequent observations for latitude were taken. All corners on these lines were marked, whether in woods or in prairie, by mounds and posts.

Manual of Survey, 1881.
(Second Edition).

Certain changes were made in the monuments to be established at corners. Bearing trees were to be marked with a knife or scribing iron, while the distance and bearing from the corner to the tree were to be marked with red chalk. Wooden posts in prairie were to be four feet four inches long, driven twelve inches in the ground, stand two feet and a half in the mound and project ten inches above the mound. Quarter section posts were to be marked with the fraction ¼. Sods and all foreign substances were to be excluded from earth mounds. Pits were to be dug three feet square and eighteen inches deep, their centres being four feet and a half from the centres of the base of the mound. A rope skeleton was recommended to faciliate the speedy marking out of the position of the mounds and pits at a corner. In a stony region the mounds might be built of stones, no pits being required. The post which was planted in the centre of a witness mound was to be marked "W. M." with a knife or scribing iron, but the bearing and distance from the post to the corner were to be marked on it with red chalk. The witness mound was built in the form of a cone, the earth required being taken from a circular trench fifteen inches wide. All township corners were marked with iron bars where possible, and these were driven in the same position relative to the mounds as at former block corners. If a township iron post fell in a place where no mound could be erected, a wooden post of the same dimensions as for a section corner and marked "I. B.," was planted one foot from the iron bar on the side where the mound should stand. The corner was also perpetuated by bearing trees or a witness mlund. No changes were made in the markings on posts except that posts on the north outline of a township, with the exception of a correction line, were marked on the south west face with the township and range numbers. The letters "W" and "E" were to be marked only for the principle meridan.

Manual of Survey, 1883.
(Third Edition).

In 1882, iron posts were subsituted for wooden posts at section corners in prairie. They were planted in the centre of the mounds, each post being driven one foot in the ground and projecting two inches above the mound. On the top a square tin plate having the appropriate markings stamped on it was slipped over the post and held on by a nail through the post. The letters N., S., E. and W. were stamped on the tin to indicate its proper position on the post. The same markings were stamped on the tins as were formerly on wooden posts except that they were in figures instead of Roman characters. The iron posts were marked with a cold chisel on the iron itself on the south west face, with the number of the section, or with the letter "R" if on the north side of a correction line, to serve for the identification of the post should the tin disappear.

In 1886 it was decided to dispense with mounds in the grazing country as it was found that cattle tramped them down, thus filling up the pits. The earth from the pits was in future to be scattered, and the iron post was driven into the ground to within ten inches of the top.

In 1889, the tin on iron posts was discarded, a slightly larger post being used and the marking made on the iron with a file or cold chisel. It was recommended by the Inspector of Surveys, that posts and mounds should be made at all corners in woods, but this was not completely carried out until several years later, although partly so in the next year, in the new Manual of Survey.

Manual of Survey, 1890 (Preliminary Fourth Edition) and 1892 (Fourth Edition).

Iron posts and mounds were built at township and section corners in the woods, but no mound was made at a quarter section corner in the woods. In prairie, if wood could not be obtained within three miles, the post might be omitted at the quarter section corner. In wooded country one of the pits might be omitted when it was impracticable to make it on account of large trees or other obstacle.

Whenever stones were readily procurable, the mounds must be made of stones. A witness trench should be twenty-four inches wide and twelve inches deep. The iron post stood in the centre of the witness trench or at the point of the base of the mound nearest to the corner, and all witness monuments were to be built at the nearest suitable point on the surveyed line and the bearing indicated by one of the letters "N., S., E. or W." No instructions were given for marking bearing trees.

All corners on the boundaries of Indian reserves, settlements, group lots, or generally, that defined lands on only one side of the road, were to be built in a similar manner to those on a correction line, or line between two systems of survey.

Iron posts at corners governing lands on both sides of the line were marked on the southwest face with the number of the section, the north east angle of which the post indicated, followed by the numbers of the township and the range. Posts on correction lines were marked with the number of the section on the west face and with the township and range numbers on the north or south side according as the post was north or south of the correction line. Posts on east and west lines dividing two systems of survey were marked in the same manner as posts on correction lines. Posts on north and south lines dividing two systems of survey were marked on their south face with the number of the section, the north boundary of which they indicated, and with the numbers of the township and the range on their east or west face according as the posts were on the east or west sides of the road allowance. All marks on iron posts were to be made with a cold chisel and in Roman characters.

Manual of Survey, 1903. (Fifth Edition).

If stones were readily available a stone mound might be built, but pits were to be dug also if possible to make them. A mound and pits of the same dimensions as for a section corner were to be marked at all quarter section corners in the woods where it was possible to make them, the wooden post standing in the same position with regard to the mound as would an iron post. A monument was not to be placed on a road allowance, public highway nor travelled trail. The post for a witness mound was planted in the middle of the trench on the side nearest to the corner. Corners of group and settlement lots were to be marked the same as section corners. If iron posts were not available, wooden ones might be used. Such a post would be three feet long, squared to three inches on all four faces and driven eighteen inches into the ground in the same position as an iron post would have occupied. Monuments on the limits of a highway were the same as at section corners on correction lines. If they were made on both limits of the road, iron posts were used on one side and wooden posts, similar to those used for group or settlement lots, on the other side. No corner was to be marked by more than one monument. One face of the iron post was stamped by the makers with a crown and no marking was to be made on that face.

Manual of Survey, 1905.
(Sixth Edition).

A quarter section corner falling in a lake or marsh not over three feet deep was to be marked by a wooden post not less than five inches in diameter and long enough to be driven three feet into the ground and show six inches above the water.

A surveyor was instructed to restore every monument of a previous survey struck by his lines when such monument was not in good condition. Where any section corners had been originally marked by wooden posts, iron ones should be substituted.

In 1908 a change was authorized which will tend to greatly increase the permanency and value of the survey. This was the substitution of iron posts, similar to those at section corners, for wooden posts at quarter section corners. An additional aid towards locating one's position on the ground was given by marking witness posts, on the face away from the direction of the true corner, with the number of the section which would have been marked on the post had it been placed at the true corner.

Manual of Survey, 1910.
(Seventh Edition).

As a deterrent to the wilful removal of iron posts, they were stamped by the makers on the Crown face with the inscription "Penalty for Removal, Seven years Imprisonment."

As an aid in locating the true corner of a township or section in bush country where such corner falls in a marsh or slough not over three feet deep, necessitating the erection of a witness monument more than five chains distant, a post of the most endurable wood obtainable in the vicinity, squared at the top and marked in the same manner as prescribed for iron posts at section corners, was firmly driven at the true corner.

As an additional means of perpetuating a corner in the woods, bearing trees might be marked. The letters "B. T." and the distance to the corner were marked on the blaze with a knife. The bearing from the corner to the tree was recorded and might be marked on the blaze with red chalk or paint.

Although no mounds were to be built in prairie, yet small openings of two chains or less in extent in continuous bush country were not to be classed as prairie, but on the other hand, mounds were to be built in small wooded bluffs, two chains or more in extent, in prairie. On a contract survey the field notes should show every opening in the woods of half a chain or more. In order that the nature of the soil might be properly described, definitions of soils were given in the Manual.

Manual of Survey, 1913. (Eighth Edition).

A few changes are made in the character of the monuments. Where a stone mound is built, pits are not required, and if the country is rocky so that the post cannot be driven, the stone mound is built around the post. If a quarter section corner falls in a position unfavourable for building a monument, a witness monument is to be established in the same manner as for a section corner provided it is necessary to do so in order that at least two of the corners of the adjacent quarter sections shall be marked on the ground.

The Chairman.—I wish to congratulate you, Mr. Seymour, upon your very excellent paper. We will be very glad if any of the members will take up the matter presented and discuss it for a few minutes. This is of interest to all surveyors and I think we can have a good discussion on monuments.

Secretary Hubbell.—As no member appears inclined to criticize the statements of the lecturer, I would like to offer my congratulations to Mr. Seymour for his able treatise on Boundary Monuments, which, I think, when printed and distributed, will be appreciated by all surveyors, and at the same time remain in our records a "monument" to himself. In his remarks, I did not notice any reference to witness mounds, or pits when stone mounds were erected. I remember when the Department first undertook re-surveying, considerable uncertainty existed among surveyors as to the position of the iron post.

In most cases the mounds were obliterated and the iron posts, (which were in the centre of the mound) gone. When the mounds were rebuilt, surveyors were undecided as to whether the post should be placed in the centre of the mound or at the North corner, as required by the then new Manual of Survey. I noticed a few cases where the iron post was placed at the north corner of the mound, when it should have been left in the centre, and again, where a new post was planted at the north corner of the old mound, the new mound was built around it.

This irregularity, when pointed out to the Surveyor General, was rectified by the issue of special instructions to surveyors. I move that the Association present their thanks to Mr. Seymour for his valuable illustrated paper.

Mr. Fawcett.—I have great pleasure in seconding the vote of thanks to Mr. Seymour. I think in this paper Mr. Seymour has certainly made a monument to himself which will be handed down to generations in the future. There is one point: that tree that appeared so often squared on four sides. I think that if a surveyor would come back showing it as a section corner, I think the Surveyor General would ask how he proceeded with his line after he passed that tree. I do not think such a thing as that would pass the Surveyor General. I only recollect, in my past experience, one or two occassions when a tree would come in the right place of a section corner mark. Well, we cut down such a tree and used it as a post. That comes to my mind because that tree appeared so often as a monument.

Mr. Lonergan.—One question in regard to that short post: Is there any provision made when there is about a foot of earth and rock underneath?

Mr. Seymour.—I believe it is to be the instructions for the present year that when the corner comes on rock, or rock is encountered say twelve inches underneath the surface, the short survey post is to be planted. In case the rock is under the ground, the earth is to be removed and the post is to be planted in the rock. The length of the short post is to be about three or four inches. A little cement is mixed up and put in the hole drilled for the post. Where the rock is below twelve inches, I believe the instructions will be to use the standard post and raise the surface of the ground flush with the top of the post.

Mr. Dodge.—I would like to make a few remarks on the type of post used at the present time. Mr. McClennan, would you be good enough to put on the slide that shows the type of post that was used last year? (Slide). This is the third year for the new type of post. The first year the post was used the foot-plates were rivetted on by means of a long rivet which ran right through the pipe. The rivet made it difficult to get the concrete into the post. Last year it was thought that if the foot-plate was forced on tightly it would hold without any rivet. It was found, however, that while this was true of some of them, it was not true of all. A large number still had to be rivetted. Again it was found that some of the men in the field when planting the post used a block of wood on the top and drove the post down, instead of digging a hole to put the post in. We have, therefore, adopted new methods this year. At the end of the pipe there are six cuts made with a saw. The diameter of the hole in the foot-plate is smaller than the outside diameter of the pipe; the foot-plate is pressed on and the pipe turned over. In that way it is absolutely impossible for the foot-plate to be driven up. Mr. Herbert is in charge of this work and can explain it better than I.

Mr. Herbert.—This (pointing to slide) is the post which will be used this year. It is filled with cement when it is made, and not when it is used in the field. The hole in the foot-plate is reamed smaller than the diameter of the pipe. The end of the pipe receives six equally spaced saw cuts; the foot-plate is then forced over and the cut parts of the pipe bent down. This (pointing) is the bronze cap. It is cast in the shape shown by using a core. This (pointing) is the cast iron cone. A cone is put into a cap and the end of the pipe is forced into the annular space between the cone and the cap, forming a very tight fit. The whole post is then dipped in a vat of Mexican asphaltum.

The face of the bronze cap is then cleaned off with gasoline or kerosene, the inscription being left in black. The letters in the cap are deep enough to hold the asphaltum. The rivet in the cap has been dispensed with, being considered a point of weakness, as it can be easily removed.

This (pointing to sample post) is the type of post which will be supplied for 1917. It may be examined afterwards. The main change from last year is that the inscription "Dominion Land Surveys" has been added to the penalty clause. While this year's supply will be made according to the sample shown, the adoption of the new method of metal-coating the outside of the post will be considered for next year.

This (pointing to sample post) post was constructed by having the bronze cap brazed to the iron pipe. The foot-plate is forced over the bottom of the pipe and welded to the pipe. The welding is done with the oxy-acetylene blow-pipe using a rod of cast iron or steel as a solder. It makes a very tight and very neat joint. Afterwards the post is put into a sand-blast and thoroughly cleaned; and then it is metal-coated by means of a small metal pistol employing compressed air and acetylene gas. A metal wire is drawn through the pistol by a small turbine in the pistol itself operated by compressed air. The oxy-acetylene flame melts this wire and projects the finely divided metal into the surface of the iron post. The metal penetrates the pores and forms a very durable coating. Any material may be used: tin, copper, zinc or lead. We have samples here of the zinc and copper coating. It is considered that this coating would tend to lengthen the life of the pipe. While the asphalt coating is very durable, it is not very hard, and during transportation in the field there is always the possibility of its being rubbed off, thus exposing the pipe. The different constructions can be seen by the samples. I cut that (pointing) through to demonstrate how the cement fills the interior,—to show how solid it is. We used good cement, the best kind of cement, and it makes a good job. There is one point I would like to touch upon: some surveyors, in the past, were quite shy in planting posts in rock. To overcome this difficulty, we have experimented with different sorts of drills. We have found that it is not hard to drill even the hardest granite. The necessary hole can be drilled by one man in twenty-five minutes, and the short post set in with a little cement. The weight of the short post for rock, together with the weight of the drill, is less than the weight of a standard post, and I also think that it will be found that the rock post will be planted with less trouble. However, the surveyors are better able to judge of that than myself. I think, Mr. Chairman, that I have explained the construction of this post.

A Member.—Are the posts filled with cement in the field?

Mr. Herbert.—No, they are filled in the factory. We get the best kind of cement and sand in the factory; we could not get them in the field.

Mr. Akins.—Would it be feasible, when you encounter rock at eight or ten inches below the surface of the soil, to plant the standard post, cut it off and then plant a rock post in the end of the standard post?

Mr. Herbert.—Such a manner of planting posts would be quite feasible but whether or not it be permissible, Dr. Deville could say. I have merely the information concerning the manufacturing of these posts.

Mr. Fawcett.—Is there any special kind of drill that you could get to stand granite or hard rock. Sometimes, in putting down one of these small holes, you break two or three drills. I went to Quebec last year to find if we could get drills to stand this kind of work, so that we should not have to keep a supply of different drills. I have not been able to hit upon the right kind yet. Of course, we have all kinds of rock; we have the dry rock and hard rock, we have the bed rock, a kind of limestone formation, then you come across the granite boulders, both under or on the surface of the ground, so that we have great difficulties in keeping up our supply of drills and sometimes we break quite a few.

Mr. McArthur.—To my experience, Mr. Chairman, no drill will stand granite for a length of time and the life of a drill depends on its sharpness.

Mr. Herbert.—These are the drills obtained from Trow & Holden, in the United States, considered to be the best firm. There are three types of drills: soft rock, medium hard rock and hard rock drills. We have tried, ourselves, the hardest granite and it is true that no drill will stand up for long. It may take a drill for each hole, say a three inch hole. The question whether a surveyor should sharpen his own drills or not also came up. I don't know the decision but I think it would be desirable to carry a good supply of drills rather than carry the equipment to sharpen the drills. This equipment weighs about three hundred pounds and is quite a trouble to sharpen them. It takes an expert blacksmith to sharpen and temper these drills. We have found that one drill will drill at least one hole in the hardest kind of rock.

Mr. Dodge.—May I say a few words further on the question of the drills? Last year is the first year that we started planting posts in rock. A good number of surveyors said that it was impracticable to drill a hole in the rock encountered. For this reason we started to experiment ourselves. We used three types of drills: soft, medium hard and hard rock drills. We have altered the type of post and I would like all the surveyors who are here and who think they may encounter rock this year to come over to my office for a practical demonstration. Come over, everyone. We need the co-operation of the surveyors in this. This is the type of hammer, (shows hammer) and this is the type of drill (shows drill). So far as breakage goes, I think it is largely a matter of experience. A great deal of breakage is caused by hitting the drill too hard. We drilled a hole in the hardest granite in twenty-five minutes and we drilled one in medium granite in ten minutes. While the surveyors are in town, I would be very glad if they would come over to the office where we could discuss this question better.

Mr. McArthur.—I have had the occasion to assist in the planting of three hundred demonstration posts where it is all granite. The upper end of the pipe (?) is one inch and three quarters in diameter; the lower end is one inch and a quarter. We started our holes with a two inch drill or two and a half inch drill, a two inch drill was then used and after that a one inch drill. We generally cut through in thirty minutes in all kind of granite rock, which was the only kind of rock there.

Mr. Craig.—Apropos of speeding in ground drilling, I witnessed a contest which was held about 15 years ago at Greenwood, B.C. Two men were drilling hard rock; one man would hold the drill and the other man use the hammer. This team drilled a 53 inch hole in fifteen minutes in the hardest kind of rock.

Mr. Dodge.—I may say that these drills were not selected offhand, I went to the different stone cutters in town and it was on their advice that this particular type and make was purchaed. The firm that supplied these has the reputation of being the best firm in America for stone cutters' tools. The drills are supposed to be the very best.

Mr. Lonergan.—I come from a mining country and that is the shape of drill they use. A drill with a big enough top which tapers down to a fine point; that kind of drill has to be used by an expert. The average man cannot use it. This drill, in the hands of the average man would be exposed to jamming. The drill you spoke about, Mr. McArthur, is very hard to keep from jamming.

Mr. McArthur.—Less liable.

Dr. Deville.—I want to say a few words about this very interesting paper of Mr. Seymour's. It is to be expected that I should be conversant with the details of what took place, perhaps more so than anyone else. Generally speaking, all the changes made from time to time, were made at the suggestion of the surveyors themselves. When I was first connected with Dominion Land Surveys, the type of monument used was simply the mound, pits and wooden post. There was presented on the screen a drawing of a mound with a square trench at the foot of the mound. I never saw that. My first survey was in 1880; at that time the building of mounds of that shape had been discontinued. The reasons for the changes in monuments can be followed very well; as Mr. Seymour said, they are rather confusing, that has to be admitted, but you can see the succession of ideas. You start with a mound and wooden post. When you come to the prairie, there are no trees to make posts from and if you had posts, the prairie fires would destroy them. So the iron post is substituted and put in the place primarily occupied by the wooden post in the centre of the mound. Being short and in the centre of the mound, it went only six inches in the ground. And what was the result? The cattle destroyed the mound, and the post disappeared. The next idea was to plant the post at the corner of the mound and to sink it further into the ground so that it would not be so liable to displacement. One trouble that was not foreseen at the time is that the post ceased to be in the centre of the mound. A monument always had four pits and if there was a mound in the centre of the four pits, then the post was not in the centre of the four pits. That was a drawback and gave a lot of trouble. There is one principle that has to be recognized when dealing with survey monuments. You may not find it in text books but you learn it by experience. The one great requirement of a monument is permanency; if you cannot build a permanent monument, it is better not to build any. The reason is this:—When a corner of a piece of land is accurately defined and properly described, but not marked by a monument, the location of that corner is a survey operation to be performed according to precise rules which leave no room for ambiguity, but if a monument was built and that monument is lost, that corner has to be located according to the rules of the law as established by judicial decisions. Not unfrequently, these rules are very confusing. In discussing the succession of ideas that led to changes in monuments, we start with the post planted in the centre of the mound, later, the post is planted in the corner of the mound: next comes the trouble due to the destruction of mounds in prairie where they can be seen at a distance by cattle who come up to see what it means and scatter the earth all over. The following change was to make pits only, no mounds at all. But the surveyors who were working in the bush said that mounds were necessary in the bush for finding corners. Whether the mound is actually necessary in the bush, I am not prepared to say, but that was the surveyors' opinion at the time. The bearing trees formerly used were all poplar trees which disappeared at the first forest fire, or rotted in a short time. Such bearing trees were not only worthless, but objectionable, so that was cut out, but later the British Columbia Surveyors obtained permission to resume the use of bearing trees. They said very properly: "We have good trees in our country; we can blaze them and we can mark them, and we are sure to find them at the same place many years after." That was quite true; there is no reason why bearing trees should not be used in British Columbia. Some changes were not very fortunate and others were. The long post used in water which was adopted at the suggestion of surveyors, is removed by ice and then you don't know where you are. This post is a legal monument and when it is gone, you have to find the spot where it was. This post should be done away with entirely. There is no doubt that the new post is a great improvement, probably the greatest improvement made in the surveys yet. Ninety five per cent. of the troubles caused by defective surveys is due to lost monuments.

Mr. Norrish.—I would like to ask Dr. Deville, if the question has ever arisen in regard to the new monument, or has it been accepted, in the case of a post being lost, that the centre of the square formed by the pits is the true corner?

Dr. Deville.—I cannot say precisely that it has been brought up. There is no question that the post marks the corner. Whether the mound indicates the corner or not is a question that comes up when the post is gone. The Land Title Offices object to some of our surveys because we did not take into account that the post might be at one corner of the mound or at the opposite corner.

Mr. Chairman.—Mr. Shanks, have you anything to say about this?

Mr. Shanks.—I do not rise with the purpose of adding any information to what has been said. I have listened to Mr. Seymour with great interest and with all modesty I may say that I take a little credit in this matter. At one of the meetings of the Committee, I suggested that a paper on monuments be given us. Speaking from the office standpoint, I have always felt that some book of reference on monuments is absolutely necessary. Mr. Dennis' paper and the annual reports were very helpful, but I do not think the full value of this paper will be discovered until we see it in our reports. I also wish to say that I appreciate very much the remarks of Mr. Dodge, Mr. Herbert and of the Surveyor General.

Mr. Chairman.—I am sure that we are just started on the discussion of this paper of Mr. Seymour's. I think it is to be a monument to himself and I have no doubt but at future meetings of this Association the many questions brought up and placed before us will be further discussed, all to the advantage of the surveys being made. There is no further discussion and as the time is getting along, I would ask somebody to move a vote of thanks to Mr. Seymour for his lecture.

Moved by Major Hubbell, seconded by Mr. Fawcett, that a hearty vote of thanks be tendered Mr. Seymour for his interesting paper. Carried.

Mr. Seymour.—Mr. Chairman and gentlemen, I thank you very much for the interest taken in the paper and the discussion that followed.

The Chairman.—There are just one or two matters I would like to metion before adjourning. Mr. Lonergan was to have read a paper on "The Selection of Horses Suitable for Survey Work", but the matter of monuments was so fruitful of discussion that we shall have to put Mr. Lonergan's paper off until this afternoon. Also, the Secretary is ready, at all times, to take in any fees the members would like to pay and he will sell tickets for our annual banquet to-night at the Chateau Laurier. The meeting will stand adjourned till this afternoon.

MR. SEYMOUR.—What time this afternoon?

THE CHAIRMAN.—Three o'clock.

SECRETARY HUBBELL.—I have for this afternoon a paper from Mr. Bridgland on "Triangulation in the Rocky Mountains." As we are so pressed for time, I think we might consider this paper as having been read and have it inserted in our annual report.

THE CHAIRMAN.—This afternoon we are going to try to bring up different matters relating to the welfare of the Association and I hope many will come out.

The meeting adjourned.

The session resumed at three o'clock p.m.

SURVEYING AND TOWN PLANNING.

By Thomas Adams, Esq.

Town Planning Adviser, Commission of Conservation.

As a general rule there has been no proper planning of rural and urban areas in Canada, merely adherence to a rectangular system of survey. Land has been divided according to certain principles laid down by land surveyors, to whom have been assigned greater responsibilities in defining boundaries of municipal areas and land divisions than in older countries. The system originated in the United States, and, both in its inception and development, appears to have been designed to promote speculation—both private and public—rather than the economic use of the lands. From the surveyor's point of view it appears to have been influenced in its growth by two main considerations. These were, first, the necessity of mapping out the territory on a geometrical plan, without regard to the physical features of the surface of the land owing to the vastness of the areas to be dealt with, and, second, the need for accuracy and simplicity in defining boundaries of the different units of a geometrical system.

Another influence was of a political rather than of an engineering character. A regular and comprehensive system had to be adopted to enable large areas to be surveyed in advance of settlement for government purposes. Population had to be attracted by the offer of free homesteads or cheap land, without time and thought being given to the planning and classification of the land for economic use and development or to the distribution of the population to secure successful and permanent settlement. The population thus attracted or anticipated gave a stimulus to both private and public speculation in the development of natural resources and means of transportation. Everthing that contributed to that stimulus was encouraged, and anything that militated against it became an object of criticism as an interference with the free play of natural forces. Having regard to this speculative tendency, and to the need for meeting the competition of other countries in attracting population, the kind of planning or surveying adopted probably served its purpose, but it permitted no discretion or intelligence to be exercised by the surveyor beyond what was required to accurately define and locate the boundaries according to a rigid and inelastic system.

Proper planning should follow no hard and fast rule. It should intelligently dispose the boundaries of at least the smaller divisions of land to suit industrial requirements, to conform to the natural conditions and physical features of the locality, and to pro vide for the most economical, convenient and healthy development. The American system, adopted in Canada, is unsound, to the extent that it falls short of this standard, even if it could claim to be simple and accurate and to have succeeded for a time in attracting population by speculative means. Of course, it is not claimed that a new country can be developed without speculation, or that properly regulated speculation is injurious. What is injurious is when speculation is the object of development, instead of one of the means by which proper development can be accomplished. Every large railway enterprise is a great speculation, but, if the sole object in constructing a railway is to create and speculate in land values, it may become a social pest instead of an instrument of sound development. A government may be a speculator of an injurious kind if it stimulates immigration and land settlement without proper plans of development, and without proper regard to the social and economic needs of the settlers, although it may receive no actual coin in the process. The proper object of development should be production based on healthy living conditions, and not the mere accretion of numbers. When that is the object of a government it will not unduly faciliate land settlement until the land is properly planned and arranged for the purpose, and until steps are taken to prevent injurious speculation.

Under the Dominion Lands Surveys Act of 1908 land is required to be laid out in quadrilateral townships, each containing 36 sections, and each section divided into quarter sections of 160 acres. While, however, this system is adopted for general purposes, the Surveyor General has power, with the authority of his Minister, to depart from the system in respect of certain lands. For instance, lands bordering on a river or watercourse can be surveyed or laid out in such manner and with such roads as appear desirable. Under such conditions it is provided that, in the case of settlements already in existence, a road 66 ft. wide has to be laid out across the settlement in the most *convenient* location.

Surveys are now made more accurate and elaborate than formerly, and a good beginning has been made in recent years in collecting information regarding the situation and character of townships. This, however, is not sufficient, and is too general in character, to provide a basis for classification or a proper system of settlement. A series of reports from surveyors' field books has been published, giving particulars of the nature of the soil, timber, water supplies and powers, climate, etc. It is thus seen that the surveying department of the Dominion Government recognizes the advantage of obtaining more complete information regarding the character of the land when it is surveyed. The fact that the department reserves to itself and exercises the power to vary the survey for small areas in certain circumstances shows that there would be no difficulty in making a similar variation in respect of larger areas.

Writing, in 1906, with regard to the system in vogue in Ontario, Mr. J. F. Whitson, O.L.S., who is now representative of the Provincial Government in Northern Ontario, stated that one-quarter of the agricultural land in that province was not then surveyed, and "if changed conditions of agriculture within recent years require some change in the system of survey it is not too late for the government to make the change."

It is unnecessary in this report to go into the merits of the different systems in vogue in Canada. The Quebec system, with its narrow and deep lots, the 1,000-acre system in Ontario, first adopted by the Canadian Land Company in 1829 and later by the province, and the revised system now in force in Ontario, seem to possess great advantages over the Dominion square sectional plan as a means of securing closer settlement. For 100-acre farms the 1,000-acre section system seems as good as any stereotyped system can be. The new system adopted in Northern Ontario does not depart in a material degree from the older Ontario systems except in regard to the increase of the size of the township from six to nine square miles. There seems to be no doubt that for purposes of local government the six-square-mile township is too small. Townships should be from twice to four times the present area and, as has been proved in some counties, this lessens the cost of administration without any loss of efficiency. But convenient distribution of the farms and a good road system cannot be obtained with any rigid rectangular lay-out. Nature has provided rivers, lakes, watersheds, swamps, and mixed areas of good and bad land, which should all be allowed to influence municipal and farm boundaries. But even natural boundaries are not always ideal, and any proper system must have regard to employment of intelligence and discretion. In dividing the land for settlement, natural boundaries should be used as alternatives to the artificial lines of the surveyor and greater discretion should be employed in determining which boundary to use in the smaller units. It is recognized, however, that there have been certain difficulties to be surmounted in a country where the system of land registration required divisions to be made for large areas for settlement before the land could be surveyed in detail. For county areas, perhaps the rectangular system could not be greatly improved upon except by making deviations at the edges of lakes and at river intersections.

Township Planning.

It is, however, when we get down to the units or sections that lie within the township that greater room for improvement is found.

Whatever excuse there may have been in the past for rigid adherence to the rectangular sections, because of the want of men and organization to plan these sections with some regard to physical conditions and future development, there is no longer any excuse for such adherence—although in the case of purely level land, without river intersections, this kind of plan is satisfactory from some points of view.

In territory to be opened up in future a more elastic system of planning should be followed within township boundaries, and regard should be paid to future development, to existing railways, topography, character of soil, and other physical considerations, without any sacrifice of accuracy. The increased cost of making more detailed surveys than at present would be small compared with the saving that could be affected in getting roads in the right place, in lessening the length of roads, and in securing economic distribution of the land; and also compared with the advantages which could be obtained in greater convenience and healthier conditions of development. Moreover, the surveys need not be spread over such large areas and should follow a more concentrated system of land settlement, dealing first with the more fertile lands and with those lying nearest to the means of distribution. It is a fact that, even with the absence of any plan of agricultural areas in older countries like England, the results are better in important respects than in Canada with its rectangular system, because, in the former case, some purpose of using and developing the land has been the primary consideration in its planning, rather than simplicity and accuracy of arrangement to suit a particular mode of placing settlers. There are still enormous areas of new territory in Quebec, Ontario, and in the western provinces where some improvement in system might be adopted.

In parts of organized territory already divided and, to a more or less extent, alienated in homesteads, some readjustment is still possible, and in any event control of future development and of areas where cancellation has taken place can be provided. There are large areas of uncleared and swampy land near to towns and railways which can be rendered fertile at reasonable cost for clearance and drainage, and a thorough survey of such land should be made with a view to securing its improvement and development. But any replanning as distinct from regulation of future growth of such territory raises difficulties which can only be partly overcome very gradually, under expert advice. The whole matter should be dealt with by a system so designed as to gradually secure closer settlement, better facilities for making farming more attractive and profitable than is practicable under the present method and for the reduction of the unnecessary lengths of road reservations. Every township boundary could be determined under the present system, but no land should be homesteaded or boundaries fixed within the township boundary until a proper plan of development for the whole township was prepared and approved by an efficient director of surveys acting in collaboration with a skilled director of planning in each province. The farms should be laid out with proper regard to the fullest and best use of the land, to convenience and ease of access, to obtaining facilities for water supply, transportation, health, amenity, etc., while the highway system would accord with a provincial plan of main highways.

Object of Surveys.

In spite of their defects, it is probable that no better series of systems of surveying lands could have been devised when we have regard to the object of making the survey. That object—important in itself—was to secure accurate measurements and divisions of the land for rapid settlement; and the fact that it did not include a topographical survey, a scheme of classification of the land and planning of the roads was no fault of the surveyor. His duties have been circumscribed within a narrow radius and within that radius he has performed his task with great skill and energy. Under the leadership of Dr. Deville, the Surveyor General, the surveyors of Canada have given able and devoted service to the country, and it is necessary to make it quite clear that what is objected to is not the work or methods of the surveyor, nor the rectangular system as a means to secure accurate measurement, but to the fact that the scope of the surveyor's duties has been too limited, and that the rectangular system has been used as a plan for land settlement. *The surveyor should not only measure the land, but make a survey of its conditions in the real sense; and the rectangular survey should not be the plan for settlement, but only provide the basis on which a proper development plan for each township should be prepared.*

Objection have occasionally been made to the system of rectangular survey by those who have noted its defects as a plan of land development; but as it is not a plan of land development at all, and its geometrical and rigid character make it unsuitable for such a plan, the survey should not be objected to on that ground. The objection should be to the fact that a survey designed for one purpose is used as a plan for another purpose; that it is so used without regard being paid to the soil, topography and future development; and that farms are divided and roads located without any properly conceived development scheme being prepared for the areas in which they are situated.

It cannot be too often emphasized that what is required is the departure entirely from any kind of rigid system, except for measurement purposes, so that more discretion may be permitted, and regard paid to topographical and physical conditions. While this is true of areas which are surveyed and laid out for purely agricultural purposes, it is even more true in cases where land is being subdivided for building. New towns and villages are now being laid out in connection with such rural industries as mining, fishing and those connected with pulp mills and other forms of manufacturing.

Townsites and Building Sub-Division Plans in Rural Areas.

In so far as the system of laying out new townsites or suburban land in rural areas is defective, it injures such areas and adds to the administrative burdens of rural municipalities. Those who advocate town planning are sometimes met with the argument that a city or town grows and that it is not practicable to artificially direct its growth. To anyone who is acquainted with the process of town development on the American Continent this argument must sound absurd, since there could be nothing more artificial than the method of laying out and developing United States and Canadian cities and towns.

Sites for new towns are most frequently selected by the railway companies, which, naturally, have regard, in the first place, to the locations most convenient for the area served by the railway, and, in the second place, to what will assist them in selling and developing their own land. The Canadian Pacific Railway Company says its real interest in the settlement of land only begins after the land is sold to the settler, and it has demonstrated this by the way in which it operates demonstration farms and employs expert advice for those who colonize under its system. The business instinct of this and other companies naturally lead them to select the townsites most useful to them—although it may not be the best for the public interest as a whole.

The chief advantage of the rectangular plan is, unfortunately, that its uniform lot sizes and dimensions assist speculation in land. It suits the interests of speculating owners who act without regard to the public welfare. Starting with the unit laid out by the surveyors in the first instance, the city or town is gradually developed in separate pieces, without any one piece having a definite relation to the other pieces.

The influence of the system of laying out land for agricultural purposes on the system of laying out land for building purposes is seen in all countries, but probably the most direct connection between the rural and urban systems of survey is to be found on the American continent. The rectangular system of lay-out of the city and town in the United States and Canaba has been less a matter of choice by those who laid out the land for building than a matter of evolution from the square mile section to the right angled building lot. Some of the critics of the kind of rectangular plan which has prevailed on this continent seem to overlook this fact. The criticism of Mr. H. R. Aldridge, that the plans of American cities are "little better than block plans of sites, planned grid-iron fashion to faciltiate the operations of speculators in real estate," cannot be denied by anyone who has made a study of city growth in the New World. But the origin of the plan seems to have been the rectangular system of survey in rural districts, and this was not deliberately designed to facilitate speculation although one of its results was to do so. We thus see the important connection between rural planning and surveying and city or town planning, and between rural planning and speculation in building lots. The greater part of new development in the future will take place on what is now rural territory under the administration of rural councils. These councils are now laying the foundations of the future extensions of cities. They have the power to prevent most of the bad conditions of development, as by the time the city or town extends its boundaries, to include the partially developed areas outside, the conditions and planning in these areas are to a large extent fixed.

We have seen that the influence of the rural plan on the urban plan is not confined to new countries. But it is mostly in the new countries that the rural plan is rectangular and so completely ignores the topography of the ground. The main roads and farm and field boundaries of Great Britain have some regard to natural conditions, so that, with all their irregularity, they provide a better foundation for the urban plan than the rectangular survey plan of rural Canada. As already argued, the rectangular survey plan should be disregarded except as a means of facilitating correct measurement, and the land could then be planned, first, to secure its best economic use for agricultural purposes, and, second, to adapt itself to the natural features of the country side. When this land became adaptable for building purposes, it could then be replanned to fit in with the general plan of the city or town, and the rural plan, being a topographical plan, would provide the right basis for the city or town plan.

The Chairman.—This meeting, I think, will go down in our proceedings as a most unique gathering. This is the third radical change, at least a radical modification, of the present system of surveying that has been suggested to the Association. One gentleman told us of the very great change to be made in the monuments, another suggested changes on subdivision methods of survey, and now we come to something very different in the matter of subdividing townsites. We will be glad to hear from any members of the Association.

Mr. Seymour.—I am very delighted to be able to move a vote of thanks to Mr. Adams, who had to postpone a trip to Toronto in order to speak to us and be at our banquet to-night. I feel that I should receive some of your thanks as I suggested to the committee a paper of this nature and further suggested Mr. Adams as eminently qualified to furnish us with it.

To-day, at a luncheon, a number of us had the pleasure of hearing Mr. J. S. Dennis, D.T.S., who was at one time Inspector of Dominion Land Surveys. He has recently been elected President of the Canadian Society of Civil Engineers. At the Ottawa Branch he gave a most interesting address and I am glad that he is here now to give us a few remarks.

The excellent system as at present practiced in the West, of surveying meridan and base lines and even to township outlines, could undoubtedly not be improved upon. But when we come to the planning of a township, itself, I am in agreement with Mr. Adams that topographical and other features should be considered. To come to practical details, the lines now run as section lines could be used as trial lines to which topography could be referenced. To each transit party there could be attached, at comparatively small extra expense, a topographical party to determine the topography with sufficient accuracy for planning. The returns of the summer work could, during the winter, be plotted and the township planned in conformity with topography or other important social and economic considerations for the next year's "location" survey.

The Chairman.—Now, gentlemen, the matter is before you.

Mr. Norrish.—I would like to second the motion for a vote of thanks to Mr. Adams. We have been possibly too much interested in the ordinary system of survey. I would like to hear some discussion by members who are more aquainted with the ideas expressed by Mr. Adams.

Dr. Deville.—Mr. President, like everyone here I have heard Mr. Adams with a great deal of pleasure and certainly the aims of what he proposes are in the interest of the future occupants of the land. But we must not condemn everything that has been done in the past without looking into the circumstances under which it was done. Our Dominion Land Surveys commenced in the prairies of the West at a time when Canada was not a rich country. You must remember that in 1880, when the annual expenditure of the Dominion Government was thirty millions, one million was spent on surveys; that was a big sacrifice for the country and it was looked at in that light by the men who were at the head of the administration of the Dominion. It was also believed that there was an endeavour to cover too much country. We did not cover too much country; on the contrary, it was all we could do to survey the land grant of the C.P.R. Later on, when the boom struck the West, as soon as it reached a small town or villiage, everyone hurried to a surveyor to have his land surveyed and put it on the market. The rectangular system being the quickest was employed. The surveyors had to do what their employers wanted them to do and so the land was subdivided that way. In more recent times, we have been handicapped by the contract system. I have no hesitation in saying that it is impossible to carry out any decent, reasonably accurate system of subdivision of the land under the contract system. Fortunately, we have a Minister who has understood the limitation of the system and who has come to the conclusion that in view of the increased value of the land, the time had come for that system to be abolished. Now we are subdividing land as it should be done. One of the first steps has been to improve the mode of surveying generally. We have improved the monuments erected; we have improved the amount of information regarding surveys; we are securing information as to the timber found on the land and we can get a great deal more information. I quite agree with Mr. Adams that our survey is incomplete. We should get the complete contour of the land that we are surveying, but I am not prepared to say that the rectangular system of subdivision should be departed from. I still think it is the best system that can be adopted and one of the best systems in the world. You must have a solid foundation for what you plan and the best foundation you can get is furnished by the township survey. That does not mean that you are to dispose of the land in square sections or that the roads are to follow the section lines; you can modify that as you please later on, but, as a foundation, there is nothing better than the rectangular system as we have it. We must also consider that Canada is a very big country. In smaller countries, New Zealand for instance, the land surveying is more elaborate. First they lay all their roads, then divide the land the roads give access to and the farms are marked out. In Canada, when the surveys are commenced and for a long time afterwards, the land has very little value and it is difficult to answer the objection: "Why are you spending so much money when the land is of so little value?" And you have also to convince those who think that whenever you speak of improving surveys, it is only a surveyor's fad which is of no practical value. These are difficulties which have to be considered. But I quite agree that our surveys are incomplete and that they should be made complete. That should be the aim of the Surveyors' Association as well as that of the Government.

We have with us the son of the man who inaugurated our system. We would like to hear a few remarks from Mr. John S Dennis.

Mr. J. S. Dennis.—I have listened with a great deal of interest to Mr. Adams' suggestion with regard to the improvement of the survey system. I have also listened with very much interest to the Surveyor General's explanation of how that system was good and why it was necessary to follow it. The old members of the profession who can look back to the old system, probably note that the system we have now is not the same one. According to the system inaugurated by my father and which was first started in Manitoba, the township contained a larger number of sections than now and it was based on the American plan of following the outline. What was the first system adopted? It was, however, amended by adopting the oblong along all sides of the section, one and a half chains in width. That has been further amended by cutting out certain road allowances. There is no doubt at all that the rectangular system is a good one, from what I have heard my father say and from what I have found in the reports. The decision to adopt the rectangular system was a wise one. It was the best method we could have adopted. Now I agree, however, with some suggestions made by Mr. Adams. The Surveyor General has put in a very clear way the limitations under which the surveys were undertaken and under which they have been carried out since. I was particularly glad to hear that his Minister now has realized that it is time to improve the methods and further survey the land that was surveyed in the old days. Out in Alberta, we have three thousand acres on which we have spent $18,000.00. I thought that we might make the land more attractive to the prospective buyer by using the square system of subdivision. We laid out the roads on a basis by contour. Then we used the square system and we laid the land out. We surveyed it and got the plan adopted in place of the Dominion Land Surveyor's. Then we thought that we would have no trouble at all selling this land to the people. Well, we took a number of people from the other side of the line there and we did succeed in selling a few lots but not very many. Then we took a lot of people from Alberta and Saskatchewan and we tried to have them settle on this land. They moved off after staying some time. We had all kinds of complaints about this system. The square system is a good one but the actual fact is that the large majority of the people on this continent who can be expected to take our land in the West want the rectangualr system and we cannot interest them in any other. But here is another extraordinary fact. I know something of it because of having worked in the Department of the Interior, and under the previous Surveyor General, I undertook to have something to do with the improving of the roads of the West. Owing to our system, a great many roads are where they should not be, and where some roads should be, there are none. And you will sometimes find that there should be a road crossing a ravine, running up a ravine, and naturally it is expensive to make the right kind of a road. After thinking it over, I came to the conclusion that the system they had then and we have now was good, and by simply improving it produced a better system of roads than those you could lay down now. That is, in the large part of the country, the percentage of roads in the wrong place is so small that you can make a better road system by making a number of diversions from the present roads. We adopted that system. I think that in certain districts it would be worth while going away back to the original idea of including the road allowance in the subdivision. I agree with the idea enunciated by Mr. Adams that the time has now come for Canada to devote a little more attention and give a little more consideration to what we may speak of as the ethical site. That is, we should give more attention to locating people in the proper place and refusing to let them locate in the wrong place. Our Homestead Act is entirely out of date. It did good work in the start but it has outgrown its past. We should have a provision under which the land would be colonized on the basis in reference to location of the farm, and, as soon as that is settled, until finally, by process of elimination, you would have all the land settled. We have tried to follow that policy for many years and it is working out successfully. I have always been proud of the fact that I have some connection with the surveys in the West. The rectangular system, while it has its faults and may not be as complete as Captain Deville would like to have it, is still the best system under existing conditions, and now the time has come when we should consider modifications.

The Chairman.—Mr. Mountain is in the audience. Would you have something to say to us?

Mr. Mountain.—I have listened with great pleasure to Mr. Adams, Dr. Deville and Mr. Dennis. I have heard them before and I am always pleased to hear them on the question of planning townsites. The word planning brought up to my mind a little question: the township on the prairie. In the West, townsites are placed on each side of the railway, the Canadian Pacific being as guilty of this as anyone else. Those townsites are planned by the company, the Canadian Pacific being equally guilty. The result is that when the railway builds its yards and workshops *they are on one side of the railway line and the town is on the other side.* The surveyor runs his main street; it is usually called Broadway; the other streets are called after the surveyor or the man who owns it.

In the infancy of the town, two or three houses are built on each side of the yard and then the town grows up in the same way and the railway thus runs through the town. I am not speaking of Calgary or such other towns. I want to say this: in planning those townsites in quarter sections it should be retained on one side of the railway. Then I want to say that, in my opinion, the railway should work in harmony with the owners by putting their utilities; elevators, yards etc., on the same side as the town. I have had the honour of being a Dominion Land Surveyor. For many years I have not practiced but it has been very useful to me. Getting back to Mr. Adams' question of planning, I agree with him in many cases. I regret I was not here with you yesterday but the duties of the Railway Board did not permit me.

Mr. Dennis.—May I be allowed to say just one word in regard to Mr. Mountain's remarks about the townsites in the West? The Canadian Pacific owns sixteen townsites in the West. However, I want to correct him in this way. Since, I think, the first years of the Railway Commission, the regulations in regard to townsites is that they should be on one side of the line. However, as the place grows the people insist that they want the city on both sides of the line. The result is that the town grows up and we have the question of the crossing. In big cities in the West, like Regina, etc., following on to Calgary, not so marked there because this city was there before the railway was, you find the railway line runs right through the centre of the city. When you reach that stage, it is a question of the municipality and railway authorities getting together to divide the cost of subways. In fact, a great many of them come to Mr. Mountain's organization and want subways before they are done. Then we come to the question of the crossing; Mr. Mountain has made one suggestion: that the authorities of the railway put all their utilities on one side. I want to call his attention to the fact that if we attempted to place one big elevator or two or three small elevators on one side, we would promptly hear from the people. There is not any doubt to my mind that the modifications advised by Mr. Adams are absolutely correct. In laying out towns, the work should be given to expert town planners. We should give this our prompt attention so to provide great facilities for the town the way he indicates. We have spent too much time and too much effort in Western Canada, and this specially applies to British Columbia where the conditions are different. A great many men thought they had the winning cards up their sleeves and they find out they have mysteriously dissappeared from there. I think we have got out of the get-rich-quick man stage. Mr. Adams' suggestions regarding town planning are of the greatest value and should receive great consideration at your hands.

Mr. Seymour.—Permit me, Mr. Chairman, to speak again. About the road allowances, I might say that in Quebec they have always allowed five per cent. of the land surveyed for roads which may be located in the most suitable places. In British Columbia, when a township is laid out or when lots are staked, no road allowances are surveyed but reservations are made in land grants for roads that may be subsequently located. Mr. Dennis has given several reasons for the success of the old system on the prairie. But at least one change that should be made in rough wooded country is not to predetermine the location of roads but to leave them, to be located after survey, in conformity with topography. I feel, of course, the fact that the old system which has in many cases suited the farmer should be considered. But while some prefer rectangular lots, there are some, and especially returned soldiers, that will no doubt care more for the social end of it. They may well insist that towns and villages be laid out so that they may live there in a better way than the system followed at present permits.

Mr. James White.—I regret that I was not here during the reading of Mr. Adams' paper. But Mr. Adams has spoken on the subject before, and of course, we have had numerous discussions on it. I quite agree with him. I know of no better instance than the case that Mr. Dennis stated: when they subdivided the two townships as they should be subdivided, but the people did not want them. It is just for such reasons that the Commission of Conservation are carrying on an educational campaign as to the better planning of rural areas.

Mr. Adams.—I am glad to have an opportunity to reply to the objections raised. It is hard to get objections at some meetings and that is one of the advantages of being here. I don't think I said anything in my whole remarks against the rectangular system as a means of ascertaining the measurement of land. I did not say either that surveyors were to blame in any respect for what had been done, but, at the same time, what I did say was that the surveyor was powerless in regard to planning the land for use and development. I would like to draw attention to one fact: that the comparative close occupation of Quebec has enabled the Quebec people to say that their system has been the most successful in keeping the men on the land. The old French system has enabled Quebec to maintain its rural population at a time when Ontario population has decreased. I entirely appreciate what Mr. Dennis said on the subject of their two experiments; the farmer is the last man to appreciate a new idea, he is too conservative and too slow and is not prepared to look at it in the same way that the C.P.R. can look at it. The question can only be solved by creating object lessons and carrying on other educational work. I think the present system has probably been the only one possible under the circumstances. It seems desirable not that the surveyor should change his system but that he should extend it and make it adaptable to circumstances. After preparing his survey he should suggest the main lines of development suited for the area, classify the land and recommend some scheme of settlement to the government. If surveyors would develop that particular line of work as experts, they would become even greater public servants than they are now. Land that has been surveyed is not all settled or occupied. People will take up land because they can get it for nothing, even if it does not yield anything; there should be more common sense and business principles applied to homesteading. We see the depression and isolation of the rural population on the one hand, and the congestion in our cities on the other hand; we have improfitable farming side by side with the high cost of living, and many other problems. Of all our problems the conservation of life is the most important factor of Canada, for while we might say even in the presence of Mr. Dennis, that we have unlimited railways, while we know we have practically unlimited resources, we are absolutely limited in regard to the amount of human energy to utilize these resources. If the surveyor will consider how he can develop the knowledge to enable him to advise with discretion in regard to the laying out of lands, he will be conferring a benefit on the country and he will lay a foundation—and that is all any of us can help in doing—for a better national structure in the future.

Moved by Mr. Seymour, seconded by Mr. Norrish, that a vote of thanks be tendered to Mr. Adams for his very interesting address. Carried.

The Chairman.—The next item on our program is a paper by Mr. Lonergan on the "Selection of Horses for Survey Work."

SELECTION OF HORSES SUITABLE FOR SURVEY WORK.

By G. J. Lonergan, D.L.S.

The object of this paper is to aid surveyors in selecting horses suitable for survey work, in detecting the most common defects, and in judging the conformation of a horse so as to avoid animals that may be predisposed to unsoundness.

As sound limbs are most important, cripples being useless, I propose starting at the ground and working up. It being impossible to give dimensions we shall have to judge by comparisons only.

The hoofs should be large, round and of a dense waxy appearance, the sole should be concave and the heels wide with a large springy frog to take up the concussion. The bars should be prominent, and no blacksmith should be allowed to cut them out. Usually the hoofs of the hind feet are found in a satisfactory condition, but they, as well as the front, are subject to quarter cracks and sand cracks. These are the horny exterior splits from the sole up and may extend even as far as the corona or edge of the hair: they may cause serious lameness, more especially when loads are heavy and roads hard.

Be careful to avoid a horse with elongated hoofs on the front feet, for they are usually coupled with contracted heels and corns, and a long toe predisposes a horse to ringbone caused by the extra strain thrown on the pasterns when the horse is moving, that is, bending over the knee. Avoid also a horse with scaly or shelly hoofs, brittle like oyster shells, and look for side bones, or ossified cartilages which occur on the front feet only. They are easily recognized, being hard lumps on each side of the pasterns close to the heel.

The pasterns should be medium in length and proportional to the rest of the leg. It is important that they should have the proper slope; for the front feet an angle of forty-five degrees, and for the hind feet an angle of at least sixty degrees with the horizontal. The necessity of this is apparent when you stop to realize that the concussion from the foot striking the ground, if not absorbed by the ligaments, must be taken up by the legs and shoulders, causing the horse with straight pasterns to develop unsoundness or bending over of the knees. I might remark that when speeding the point of the fetlock will often leave an imprint behind the track of the hoof.

The cannon bone is the bone from the pastern to the knee in front, and to the hock behind. A section of this bone is round, although many speak of it as flat, the only family in which it is slightly eliptical being the Arab. The leg at this point should appear flat, caused by the suspendery ligaments being set back from the bone: in running the fore finger and thumb down in front from the knee to the pastern between the ligament and the bone your thumb should be able to feel the point of the finger with only the two layers of skin between.

Splints are located on the front cannon bone. They are bony growths, and if not so close to the ligaments or joints as to interfere with their functions, are not considered serious, and in the case of very young horses, will often disappear as the horse matures. Many judges consider splints as blemishes if not too close to the ligaments or joints.

The knees should be broad and well defined, and there should be no shrinkage in width below them. The tendons should stand out prominently.

The hock is the most important joint in the whole body of a horse. To assure sound hocks width and proper alignment of the legs are indispensable. Since the front legs may be considered as only props to support the body, and almost all the power to push the body forward, either for speed or draft purposes, comes from the hind leg, they may be considered as a loaded beam supported at each end, and the greatest strain coming at the centre. The centre of the beam in this case is the hock, which we find subject to the following unsoundnesses; curb, thoroughpin, bone spavin and bog spavin. These unsoundnesses will not be found on a horse that lines up as shown in the diagram unless the animal has been subjected to some very severe strain.

Curb is found just below the hock and to the rear. It is a thickening of the ligaments and can be easily detected from a side view, as a straight edge should parallel the back of the leg from the hock to the fetlock. Curbs are found on horses whose hoofs are too far forward.

Thoroughpin is located between the oscaltus and the bone: it is a soft swelling that can be pushed through from side to side, and should be more particularly looked for in horses whose hock lines out too much.

Bone spavin is the most common and worst of all unsoundnesses of the hock. It is a bone deposit that nature throws out to strengthen the weak hock and as it develops it interferes with the horses action. To detect it, stand forward and look back to the hock. A slight enlargement will be noticed. When the horse is in motion the toe will strike the ground first instead of the heel, but a clever blacksmith, when shoeing, will rasp the toe down and leave the heel high, which may at first be deceiving, but if you pick up the hind foot and press it close to the horse's body, holding it in this position for about a minute, and, as you are about to drop it, start the horse forward, he will, if he is spavined, walk extremely lame for a few steps. This test never fails.

Bog spavin is somewhat similar to thoroughpin. It is found in a depression in the inner front of the hock, caused by an accumulation of the oil from the joint.

Avoid a beefy legged horse. From the hock and knee down, there should be only a thin skin over the bone, and any layer of flesh between the skin and bone usually swells when the horse is resting after a hard trip.

The forearm, that is from the knee to the body, and the gaskin and quarter should be well muscled. Lack of muscle in these parts is a serious deficiency. Avoid a horse that is split up between the hind legs. The muscles of one quarter should almost unite with the other, and on extra good horses there is scarcely a break in the hair.

Standing back of the horse the two hips should be the same height when the horse is standing true. A difference of height at this point is much more common in eastern than in western horses, although found often enough in western horses to require careful attention. This unsoundness may be caused by the illium or hip bone striking the jam of a stable door. The horse then favours the sore leg and atrophy starts on that side, and the using of the other leg for most of the work develops the muscles of that side and hence the lobsidedness which may amount to as much as an inch and three quarters.

The loins should be broad and extra well muscled. Avoid a horse whose muscles appear to have withered away. If he is a pack horse he will generally play out early in the afternoon with a smaller load than he should carry, and if he is down in a soft place he will have difficulty in getting up. You should look for spring halt in such a horse, and to detect it, if it is not already evident, turn the horse quickly within his own length. It is very probable that the hind feet will come up.

The ribs should be well sprung round like a barrel, and carrying their size forward to the shoulders with plenty of depth and thickness from the withers down. Avoid horses that come up like a wedge to the shoulders for they have a delicate constitution.

A large girth is an indication of a good constitution, there being plenty of lung and heart room. The space from the short ribs to the illium bone should be short and the back should be straight with a slight drop behind the withers. The shoulders should be sloping; sixty degrees with the horizontal is not too much. This gives a short back or top line with a long under line. The shoulders and neck should be well muscled and a large collar seat is unnecessary for it is simply a lack of muscle.

Standing in front of a horse, the shoulders on each side should be well muscled and of the same size. Any difference in size is due to a sweened shoulder. One of the most common ways to sweeny a shoulder is for one end of a whipple tree to catch on a stump hurting the shoulder. The horse then favours that side and atrophy starts. This shoulder will appear flat and bare of muscles.

The horses legs should be placed under the body and not at the corners. In the latter case the horse has an awkward swinging motion when walking, and will make a very poor saddle horse. Great width between the front legs is not an indication that the animal is easily kept or powerful. An easily kept animal is indicated by the size of his girth and not by an abnormal width between the front legs.

The neck should be well muscled, increasing in size from the head to the withers, and the wind pipe should be large and appear detached from the rest of the neck. The throat latch should be clean cut, that is, it should have the appearance of being nicely chiseled and the back of the jaws should be set wide apart. If the back of the jaws are narrow, and there is any extra fulness in the throat latch, be on the look out for defective wind and test for it.

The ears should be small and pointed and carried in an erect position; a rigid ear indicates deafness. Avoid horses with mule ears. Horses that are in a hurry to start and at the end of the first hundred yards ready to go to sleep, always have a thick coat of hair on the inside of the ear.

The head should be straight and lean; the features should be distinct without coarseness. Between the eyes should be broad and the width carried well up to the base of the ears. This is an index of the brain development.

The eye should be full, large and prominent with a gentle, mild expression, such an eye as you would see in a contented cow that is quietly resting; blindness can be easily detected by a restless ear. The nostrils should be large and open as this is an indication that the breathing organs are well developed.

Action should be looked for in every horse, either draft, roadster, carriage or pack horse. Only horses of perfect conformation are true in action, and it is therefore a means of detecting poor conformation. In true action the body should go forward in a straight line with a total absence of any side motion. The front knee and diagonal hock should act simultaneously. The legs on each side should move only in vertical parallel planes. The hoofs, both front and hind, should describe the arcs of circles of the same radius and the sole or shoe should be at least at right angles to the ground when passing the centre top of the arc. All movements should be snappy, smart and quick, showing an abundance of vitality.

The age is indicated by the six upper and six lower incisors or front teeth, and is the same for both sexes.

A two year old colt has twelve small milk white teeth, called the milk teeth or colt teeth. The teeth of a mature horse are much larger and of a yellowish color.

From two and a half to three years, the centre two upper and centre two lower, fall out and are replaced by permanent teeth.

From three and a half to four years the next four, two above and two below, one on each side, fall out and are replaced by permanent teeth.

From four and a half to five years, the four corner teeth fall out and are replaced by permanent teeth. The horse is now said to have full mouth.

From five and a half to six years, the tables of the centre two in the lower jaw are worn off.

From six and a half to seven years, the tables of the adjoining tooth on each side are worn off.

From seven and a half to eight the tables of the corner two in the lower jaw are worn off.

The tables are then worn off from all the teeth of the lower jaw.

From eight and a half to nine years the table of the centre two teeth of the upper jaw are worn off.

From nine and a half to ten years the tables of the teeth adjoining the centre two are worn off.

From ten and a half to eleven years, the tables of the corner teeth in the upper jaw are worn off.

At twelve years, a star or the end of the table is still visible or about to disappear on the centre two teeth of the upper jaw.

At thirteen years a star or the end of the table is still visible in the two teeth adjoining the centre two of the upper jaw.

At fourteen years, the star or the end of the table, is still visible or about to disappear on the corner teeth of the upper jaw and the centre two are becoming triangular shaped.

At fifteen years, the teeth joining the centre two become triangular shaped and the centre two become round in the upper jaw.

At sixteen years the corner two become △ shaped, and the centre four circular. At seventeen years all are circular.

A crease and yellow streak starts on the corner teeth of the upper jaw, appearing at ten years old, and reaches the lower or exposed end of the tooth at twenty-one years. Therefore the distance down this crease has reached indicates the age between ten and twenty-one years. This crease starts to fill in at the upper end at the twenty-first year, and to reach the bottom at the thirtieth year. Therefore another proportion between twenty-one and thirty years can be estimated.

If nine is added to the number of wrinkles on the lower lid of the eye, you will have the age of an old horse.

In examining the teeth of a horse, watch out for a cribber; if the edges of the incisors are chipped and broken off he has the habit.

Collar and Saddle Sores.

A horse's shoulders become sore through badly adjusted harness. If sore on the point of the shoulder, or close to the draft point, which is generally found in horses with vertical shoulders and those that draw with their heads down, raise the draft by lengthening the lower hame strap and lowering the upper one; it may be found necessary to place an empty sack between the collar and upper hame strap, or even to drill a hole in the hames and raise the draft. If on the side of the neck about where the line passes, open wide the upper hame strap for the collar is too narrow. The collar may be sprung wider if after soaking the top in water it is buckled round a small tree and hammered with a stick and then left to dry.

If a horse becomes sore on the top of the neck, he is harnessed too tight. Lengthen the tugs so that the neck yoke falls beneath the collar, and insert a couple of green willows in the pole so that it will remain in the air with no weight on the neck yoke.

Saddle sores are caused by lack of blankets, misfit saddles, unbalanced loads, and most of all by windfall and trees left on the trail, the horse being compelled to jump over them. I might say that when visiting parties, I know before reaching the surveyors' camp, from the condition of the pack trail, if I am going to find horses with sore backs, a surveyor more or less indifferent to the condition of his horses, and a lazy packer. These things are evidenced by the number of trees on the pack trail.

Horses backs should be washed clean with warm water and castile soap, and if anything is applied let it be vaseline. Gall cure and such remedies as burn the skin during the night, should not be used, for the following day the scab will be torn off with the blanket, and will serve only to irritate the sore. You should bear in mind that the wound must be healed from the inside and not from the outside with all the puss inside.

What Horses Should be Wintered.

As horses teeth wear out as age advances, old horses should not be wintered. A surveyor may sometimes be deceived by an old horse doing as much work as a younger one, and remaining in as good condition during the summer and then the following spring coming out poor from winter quarters. During the summer the horse is able to masticate the soft grass, but cannot do the same with the hard dry hay. He therefore starves during the winter, and oats are of no benefit to him as he cannot grind them. All crippled should be disposed of as well as old horses, and horses that are not in a healthy and thrifty condition. The best means to judge the condition of a horse is by the skin and hair. If a horse is in a good healthy state the hair will lie down smooth, but if he is in an unthrifty condition it will stick out like quills on a porcupine. Catching a handful of the skin on the ribs, it should be loose and soft, and not hide bound, or tight to the bones like paint on a board.

To Value a Horse.

This is difficult, but I found the following about the most satisfactory method. First decide upon the type of animal you require, and as the market price is very variable, visit the different sales stables and find the approximate price that has been paid for sound horses in their prime of the type you require. Since there is about fifteen years service in a horse, and a horse is fit to work at four years old, he should be bought on an age basis if he is over four years old, a deduction should be applied for each unsoundness. For example, supposing the average value of a light draft horse, sound and young, is one hundred and fifty dollars, and if the horse to be valued is nine years old, five-fifteenths or one third should be deducted for age, and for a good sized bone spavin another deduction of about ten or twelve per cent. If in poor condition, from five to ten per cent. more should be deducted, and so on for each defect.

The Chairman.—We have listened, I am sure, with great interest to Mr. Lonergan's very practical paper. We would be glad to have some discussion on the matter. You can ask any question of Mr. Lonergan on the points that have been referred to.

Mr. Henderson.—I don't pretend to know much about horses but I have listened with great interest to Mr. Lonergan's paper. It will be a great benefit to us for I don't think surveyors, as a rule, know much about horses. Most of us who were brought up on the farm have been away from it so long that we have forgotten what we did know about horses. I would like to make a motion that a vote of thanks be tendered Mr. Lonergan for his paper. I was not aware until a few days ago that Mr. Lonergan is an authority on the subject on which he has spoken.

Secretary Hubbell.—I take great pleasure in seconding Mr. Henderson's motion, also advantage of this opportunity to offer a few remarks on Mr. Lonergan's subject.

I may say, that I have had considerable experience with horses during my life. As a boy, I learned to harness, ride and drive them and look after their welfare and keep.

With the object of ascertaining an opinion from surveyors, as to the best class of horses for use on survey parties, and treatment of same, I submitted a number of questions relative to this subject to several experienced surveyors and from their replies have compiled the following memorandum:—

Horses for Survey Work and Treatment.

The horses required for work on the surveys of Dominion Lands, for practical purposes may be divided into three classes—draft horses, medium sized horses for driving and pack horses or ponies.

Draft Horses.—Weight, 1200 to 1400 lbs.

Horses of this nature are required for hauling freight long distances over travelled trails or roads to and from the base of supplies to camp or caches. Generally they should be thick-set, with short neck and back, large open nostrils, good wind and weighing about 1300 lbs and not too old, averaging 4 to 10 years. These horses should be used only with wagons or carts and their loads governed by the condition of the trails. The approximate cost of horses of this nature varies, but a serviceable team should not cost more than $400.

Medium or Driving Horses.—Weight 950 to 1100 lbs.

These horses are required for use in light democrats, buckboards or spring wagons and should be of slighter build than draft horses. They should be tough and wiry, good roadsters and natives of the country. The average cost of a team varies from $250 to $300.

Pack Ponies.

Small horses or ponies used for packing and weighing from 800 to 1,000 lbs. capable of carrying from 150 to 175 lbs. each. Many of these ponies are serviceable up to 16 years of age, they are of a tough wiry nature, live where other horses will starve, require but little attention, and being natives of the country are used to climatic conditions, flies etc. The cost of these ponies varies according to locality, but as a rule the price ranges from 70 to 90 dollars each.

Care and Attention of Horses.

Heavy or draught horses require the most care. They should be sharp shod on the front feet during the spring and fall and shoes kept on all summer but taken off when in winter quarters. They should be blanketed on cold nights in the spring and fall and whenever possible, a wind break erected for their protection. They require to be fed oats when at work, three times a day, about one gallon per feed. Their feet should be looked over after every day's work and any sores on shoulder or back should be immediately treated; a wash consisting of salt and water is efficacious for sores of this nature. When grass is scarce, an allowance of hay should be fed morning and night. They should be watered three times a day and never hobbled. When an opportunity occurs they may be picketed with a strong tethering rope, at least 50 feet long, tied to a strap around the neck. It is imperative that collars should fit horses of this nature.

Buckboard Horses and Pack Ponies.

These horses do not require so much attention as draft horses, but with the drivers, it is advisable to have them shod on the fore feet during the spring and fall and blanketed during the cold wet weather. They should on every occasion be turned loose, but hobbled, except in the woods where it is dangerous to do so. The drivers require a ration of hay and oats, especially when at work. Their shoes should also be taken off when in winter quarters. The pack-ponies do not require much grain unless fodder is scarce. It is not necessary to blanket them or shoe them.

Mr. Akins.—There is one item I think very essential. I don't think a horse should be bobtailed, he should have a long tail, so that he may use it to chase away the flies, mosquitos and other insects that may bother him. Use gall cure always when the horse is working, apply it when going out in the morning, wash it off when coming in and apply a poultice of meal.

Mr. Lonergan.—Did you find that the gall cure did any good, or was the other stuff better?

Mr. Akins.—It kept the sore soft and helped cure it.

The Chairman.—This brings us to the end of our papers and there is a very considerable amount of business that has not been attended to as yet. It has been suggested that we meet in the morning to attend to it. Is that your pleasure, or is it your opinion that we go on with it to-night? There are some matters we would like to discuss and our dinner is at eight o'clock. We scarcely have time to discuss them.

Mr. Seymour.—I think we all should like to hear from Mr. Narraway about the objections which were raised to his system yesterday afternoon, and I move that we adjourn to tomorrow morning at ten o'clock.

Secretary Hubbell.—I second the motion.—Carried.

The Chairman.—I hope we shall see these gentlemen at the banquet tonight.

THE ANNUAL BANQUET.

The Annual Banquet of the Association was held at the Chateau Laurier. The chair was occupied by Mr. A. H. Hawkins, Chairman.

The Chairman.—Gentlemen, fill your glass in honour of the toast to His Majesty the King.

Members.—The King! The King! God bless Him!

The Chairman.—We have as our guest one in whom all Dominion Land Surveyors are particularly interested, the Honourable the Minister of the Interior, Dr. Roche.

Hon. Dr. Roche.—Mr. Chairman, Gentlemen:—

I am sure this annual convention of the Dominion Land Surveyors' Association is a feature that is looked forward to with pleasurable anticipation on the part of you all. It enables those of you who are engaged in the field work, as well as those engaged in office work, to group around the festive board at least once a year.

At this Convention, measures of importance are discussed and the results cannot but prove mutually advantageous. I must congratulate the Dominion Land Surveyors by reason of the fact that, like all good citizens of Canada, they have made a good showing. The large number of boys who have gone to the front, who have answered the call of duty reflects great credit upon you. If I am right, the feeling of patriotism prevades in your breast and the address I will give you will be along those lines. It is the surveyor who blazes the trail for civilization, undergoing the hardships and privations for civilization. We in Canada are passing through our days of tribulations but we have had our dark days in days gone by, possibly not in such a great extent as to-day. As we have survived those trials and privations in the past, I am just as confident, aye, even more confident of the resources of our citizens to survive the present ones. We are peace-loving people, no better evidence of this can be required than the fact that we have lived peacefully one hundred years with the United States. We have had our disputes settled by International negotiations. We have avoided the bitterment of the sword and we have been able, as two sane nations, of carrying on our affairs without reverting to armed force. We have had one hundred years of peace since Britain and France crashed at Waterloo. I am sure that I am expressing the views of everybody in hoping that the sword may be sheathed for another century of peace or more after the conclusion of this terrible war, but not until Prussianism has been crushed to death by the Allies. Our descendants should not be called to fight the battle over again that is being fought by English people, British people. Much therefore, gentlemen, as we regret the horrors of war and as we are for the restoration of peace, a premature peace would be not only absolutely useless but absolutely prohibitive. England especially must not and shall not sheath the sword until Prussian militarism has been crushed forever, and until the criminals who have destroyed the countries of our Allies have been punished for their misdeeds, until civilization has been fixed upon a sure foundation and until the other nations shall be insured against the repetition of what has happened. In the presence of this task, England shall not and will not yield. Look what France has done. The Germans had termed France's valiant army a "contemptible army", but they had the stuff in them and they had the quality. When they were brought in contact with the Prussian guard—the flower of the German army, they upheld the best traditions of the race. Look what England has been doing. She has raised, by voluntary enlistment, four million of men and it is only a few months since she resorted to conscription and she has now five million men in the field, and this for a country that was not a military country. And then again, it is not only in men that she is prominent. Look what she has done for her Allies in the manufacture of munitions; one third of the total output of her manufacturers is going to her allies. She is the banker of the Allies: one hundred million pounds she has lent them. She has employed her women in the manufacture of munitions so as to be able to let their relatives go to the front to fight against Barbars and Barbarians' armies. She has kept the seas clear for the trade of her Allies and has swept entirely off the high main the fleets of her enemy, and keeps them bottled up in the Kiel Canal. So far as Canada is concerned, Canada is a part of the British Empire. Look what Canada has been doing. Some people thought Canada could not do much, but when she sent her first contingent, 32,000 men strong, across the sea equipped and ready to get in the fight, a few months after the war, it was a reason Canada should be congratulated. When the call for one hundred thousand men came, they were raised; when two hundred thousand were needed they responded the same way; three hundred thousand were called and responded, and now we are nearing the four hundred thousand mark and we hope to have the five hundred thousand men under arms pledged in a short time. Taking into consideration, the fact that many of our Canadians are past the military age, we thought we were measuring out our full duty if we could secure five hundred thousand men, Canada will fulfil her part.

England has taken the sword in one hand and she has followed it up with civilization on the other. She has conferred the greatest amount of liberty of religion and of liberty of constitution on the universe.

Dr. Deville.—Mr. President, Gentlemen:—

After hearing the great address of the Hon. Minister of the Interior, I am afraid that I am going to make a very poor showing. I should not speak of the war but it is difficult to take our minds away from the great struggle which is to decide whether the world is to live at peace or if a man is to live with a gun in his hand watching for his neighbour's next move. A great many Dominion Land Surveyors have enlisted and more will enlist still, thus helping the great cause. I was privileged to listen to a great address at the Engineer's luncheon, and among the problems we have to face after the war is the problem of the returned soldiers and of the immigrants which we expect will come to Canada after the war is over. Several schemes have been proposed to deal with this problem. One of these is to settle the soldiers on the land, but evidently the methods used so far will not prove sufficient. We have got to do something more for returned soldiers than what has been done. One direction in which Dominion Land Surveyors can be of great use: no one knows better than they do what are the difficulties which a new settler has to contend with and no one can make land settlement more successful. I don't think that full advantage has been taken of the services that surveyors can render in this direction. We have had a lecture this afternoon from Mr. Adams, telling us what was needed in the way of surveying for settlements. The work of the surveyor is supposed to be finished when he has planted his post, run his line and divided the line into sections. But it seems to me that a great deal more may be done. The settler is allowed to select his own location. Now, you know it is almost impossible for a man who is new in the country to find out the best locations. Surveyors are the men best posted in this respect. If the settler is allowed to take up land which is not suitable for settlement, he will get discouraged and go back to some industrial centre. With proper advice he would make a good and successful citizen and a country is prosperous when all its citizens are prosperous. We have been doing a great deal in that direction in the last two or three years. We have improved our surveys in many directions, taken levels on different surveys &c., but we can do much more. If the services of surveyors are better utilized, the country will be better off, and I think that one way of employing surveyors is in solving the problems after the war. I know the surveyors themselves will not be found wanting when their services are required; if I can judge from the last meeting, they are taking a great interest in their work; what they have done in the past is a guarantee of what may be expected from them in the future.

The Chairman.—We have with us a gentleman, who although not at present with the Department of the Interior, has been connected with it and has been Dominion Land Surveyor. We would like to hear from Mr. Dennis.

Mr. J. S. Dennis.—I assure you it gives me the greatest possible amount of pleasure to be present at your banquet tonight. It has been many years since I have had the privilege of attending the banquet of the Dominion Land Surveyors. I may say, in looking back over, that the past ones were probably more hilarious than the present one, but not more in earnest. They were also more productive of a headache in the morning. Now getting back to the point, Dominion Land Surveyors were connected with the surveying of Western Canada many years ago. The oldest member present is, I believe, a toss-up between Tom Fawcett and myself. That is going back, gentlemen, a very long time. It is forty five years since I landed in Winnipeg, then a little village of eleven hundred people and practically nothing west of it. I want to point out to you that the superstructure built on in that country was laid upon the foundation work of the Dominion Land Surveyors. I don't think they have given credit for the work done in the prairie days. They were the pioneers; they put up with all sorts of hardships and privations and laid the foundation for the development which has come. They preceded entirely the matter of railway construction or anything in engineering in that country. The earlier men, gentlemen, of the profession of Dominion Land Surveyors in the West were a class of men of whom Canada may well be proud.

FRIDAY MORNING SESSION, FEBRURARY 2ND.

THE CHAIRMAN.—Gentlemen, we will now resume our proceedings. The first thing on our program will be the nomination and election of officers for this coming year.

SECRETARY HUBBELL.—The first office that requires filling is that of the Honorary-President, which is vacant owing to the lamented death of Dr. W. F. King, C.M.G., D.T.S.

Several members having conferred with me about the election of the member for this office, I have in consequence much pleasure in nominating as Honorary President, Dr. Otto Klotz, D.T.S., a man who helped frame the Constitution and By-laws of the Association and who takes great interest in the proceedings at all times.

MR. RANNIE.—I take great pleasure in seconding the nomination of Dr. Klotz for Honorary President.

THE CHAIRMAN.—Gentlemen, you have heard the nomination of Dr. Klotz. Is that your pleasure. (Applause). I declare Dr. Klotz elected Honorary President. The next office is that of President of the Association.

MR. SEYMOUR.—I have the pleasure of nominating Mr. Mc.-Arthur, our present Vice-President for the office of President. I think the success of this meeting is largely due to the keynote struck by Mr. McArthur at our first meeting, in which he brought to the surveyors' attention the fact that they should widen the scope of their work. Again, I take great pleasure in nominating Mr. Mc.-Arthur.

MR. FAWCETT.—I second the motion.

THE CHAIRMAN.—Any further nominations? Moved by Mr. Seymour, seconded by Mr. Fawcett, that Mr. McArthur be elected President of the Association for the coming year. Does that meet with your approval? Carried. Now for Vice-President.

MR. FAWCETT.—I suggest Mr. Shanks as Vice-President.

SECRETARY HUBBELL.—I have great pleasure in seconding Mr. Fawcett's motion. Mr. Shanks has advised and assisted us in many ways and I don't think we could do better than elect Mr.

Shanks to the Vice-Presidency in hopes the following year he will accept the presidency.

The Chairman.—No further nominations? Motion Carried. Next is the Secretary-Treasurer.

Mr. Akins.—I move that we retain our present Secretary. He has done very well in the past and is still doing excellent work for this Association.

Mr. Seymour.—I second this motion.

Major Hubbell re-elected Secretary-Treasurer of the Association.

Secretary Hubbell.—Mr. President and Gentlemen. I thank you very much for the renewal of confidence in me, and as in the past, will continue to do my best for the advancement of the Association.

I may say that the work of the Secretary is increasing yearly. Our reports are becoming more voluminous and expensive. The correspondence entails a lot of labour and is increasing each year. There is much detail to be attended to, that none are aware of except the Secretary; I think a younger man should be given this office, he might be more energetic and obtain more impetuous for the Association, however, as you all appear to want my services, I will do my best.

Mr. Chairman.—I think, gentlemen, the Association is singularly fortunate in being able to have Major Hubbell to fill this position. There is an enormous lot of work. The Major has given us his help to put the Association on a firm basis and now if we allowed him to retire we would do ourselves great harm, we must keep the Major in his present position. I think we may feel proud of what we have done, and I think we have done our duty.

Secretary Hubbell.—With the approval of the members, I would suggest that our new Executive consist of Messrs. E. M. Dennis, J. L. Rannie and H. L. Seymour—the two last named taking the positions made vacant by the retirement of Messrs. D. F. Robertson and D. H. Nelles who have enlisted for overseas service.

A Member.—I second the motion.

Mr. Dennis.—I believe that Mr. Blanchet should figure on the Committee.

Secretary Hubbell.—I think the men located permanently in Ottawa or thereabouts are in a better position than others to act on the executive. My idea in not nominating Mr. Blanchet is that he is away most of the time, and as we have executive meetings during the year he could not be present. The other members are here the year round; it is not that we want the Association to be run by an Ottawa clique, but it is an advantage to have the executive on the spot.

The Chairman.—The next item is that of unfinished business. There is one matter I would like to deal with. I think the Association should place on record its appreciation of the late Dr. King's services to this Association and extend its sympathies to the families of those members who have fallen in action. I think it would come under this heading very well.

Mr. Norrish.—I would like to move that the Association place itself on record as expressing its appreciation of the services of the late Dr. King whose death has been so greatly regretted, and further that the Association extend its sympathy to the families of the members who have bravely done their bit at the front.

Mr. Cote.—I second the motion.

Secretary Hubbell.—Two members of our Association have died during the past year, Messrs. E. W. Robinson and James Brady. I presume that the letters of sympathy sent out by the Association would include all members of the Association? Motion Carried.

Secretary Hubbell.—It is to be regretted that we have not the time to read the papers received from Messrs. Bridgland and Burgess. I therefore suggest that these papers be incorporated in our annual report. So much time has been taken with the various and valuable discussions, that I find two days of our convention hardly sufficient. I am sure that members will agree that more benefit is derived from discussion than in reading papers, which with the approval of the Executive can be printed in our report.

Mr. Fawcett.—I move that the papers be considered as read and be printed in our report.

Mr. Rannie.—In seconding that motion, I would like to call your attention to something which might be imitated by our Association from the Canadian Society of Civil Engineers. There is often a written discussion sent in on various papers which has perhaps as much value as the paper itself. I do not know enough about the matter to tell just what should be done in our case. I think that for the Civil Engineers the papers are sent in, printed and sent to the members first, then the discussion can be sent in at the time when the paper is read. That is not feasible with us, on account of the cost of such proceedings, but I would like to see a written discussion on any paper that comes in printed in the report. As I have said, I have not thought the matter over sufficiently to give a solution, but it is a matter that can be thought out at the meetings of the Executive. If no solution is found in the meantime, then the matter can come up again at our next year's meeting.

SECRETARY HUBBELL.—Will some member move that a vote of thanks be tendered Mr. Sykes, the Librarian, for his courtesy in allowing our Association the use of this room for our meetings, also a vote of thanks should be tendered the Surveyor General for the attention and interest he has shown by attending all our sessions.

DR. DEVILLE.—I don't think the Association need thank me for being present. I believe that I benefit more by being present than the Association benefits from my presence. I may say that it has been most interesting for me to follow the different papers and discussions that were given.

THE CHAIRMAN.—I am not quite so sure about the benefit derived. I think the Association are the people who are being benefitted.

Moved by Mr. Seymour, seconded by Mr. Akins, that a vote of thanks be presented to the Librarian, Mr. Sykes, and to Dr. Deville. Carried.

THE CHAIRMAN.—I think we ought to thank those gentlemen who have prepared the excellent papers which we had the pleasure to listen to. The Association has a great debt to pay to those members. I am sure you will all agree with me that we have had some very excellent papers.

MR. RANNIE.—I would just like to say that that motion is not necessary. It is some trouble to prepare a paper of that kind, but the key-note that Mr. McArthur sounded at the first meeting of the Association, that surveyors should broaden their work, I can assure you that one who prepares a paper gets a good return for his trouble. He broadens the question in a number of ways, has to give the subject special attention, has to be careful of the use of words, and I can assure you that it does a person a great deal of good in preparing a paper for this Association. I think there is no need of a vote of thanks, because I believe the work of preparing those papers, in itself, was sufficient reward.

A MEMBER.—The presentation of a vote of thanks to those members who have prepared the papers has been the custom right up to now and it has been adhered to. Perhaps it would be better for the Association to make a radical change, but I believe those papers benefit the Association as well as the men who prepare them. The Association ought to be very thankful to them.

The Chairman.—Before we pass on to new business, I would like to say that we should not express only in mere words, but that we should vote a grant of $75.00 to Major Hubbell, our worthy secretary, to show to a certain extent our appreciation of his very excellent sevices.

Moved by Mr. Akins, seconded by Mr. Seymour, that the sum of $75.00 be granted Major Hubbell for his excellent services as Secretary. Carried.

The Chairman.—You have heard this motion, gentlemen? I am sure that it is the sentiment of the whole meeting that this does not begin to pay our Secretary for the very hard work he does for us but this simply shows that we do appreciate his efforts and for the rest he will have to take our thanks.

Mr. Finnie.—Before we go on to new business, I would like to move a vote of thanks to our President for the way he has presided over our meetings and over the banquet last night. He has always taken a keen interest in the Association and I have pleasure in moving a vote of thanks for his good work.

Mr. Shanks.—I have great pleasure in seconding this motion. Mr. Hawkins has been an ideal President.

The Chairman.—I am sure, Mr. Shanks, that I appreciate very much the kind words of appreciation you have spoken. I have felt, all too keenly, that I have not measured up to what the President of this Association should be. I may say that the Association put one over on me when I was elected President. I was in the woods and the first intimation that came to me was a letter that came to me in March that I was elected President. I have to thank you in placing me in this high position. I have always taken interest in the Dominion Land Surveyors' Association and will continue to do so. Anything I could do, I have done most willingly. I am very pleased that Mr. McArthur is to be my successor. Under the guidance of Mr. McArthur and that of our able Secretary, Major Hubbell, I look for the Association to take great strides ahead during the next year.

Dr. Deville.—Before we take up the discussion of Mr. Narraway's paper, I would like to say a few words to surveyors about another subject. We have had some very interesting papers and very successful discussions, but there is another matter of interest for the profession, that is the material side. What is there in the future for the surveyor? It is not very bright. The surveys appropriation was cut $200,000, which means much less work. I have been giving a great deal of thought to that particular subject: What can be done to find work for the surveyors? The best thing

I could find was that surveyors should take hold of the returned soldiers settlement scheme which I mentioned yesterday. By singular coincidence, I just received a paper in which the whole scheme is elaborated by the surveyors of Western Australia. I suggest that this be copied and distributed to all the members of the Association. At the end of the paper is a Government memorandum; it was a conference of the Ministers, and the conference was of the opinion that a central body should be formed to take hold of this question. (Major Hubbell has this extract). Now I don't know if you have heard of that scheme but I have not. If a scheme like this has been formulated without the assistance of any surveyor, then I have no hesitation in saying that it is not in the best condition for success. The Western Australia surveyors point out exactly the same reason why a scheme like this cannot succeed unless it is put into the hands of surveyors. Surveyors are the only men who are qualified to make a success of a scheme of that sort. Much has been said about settling returned soldiers on the land; the proposal has been taken up by Provincial Governments, and it has also come to the attention of the Dominion Government, but nothing definite has yet been done. Mr. Dennis, yesterday in speaking to us at the Engineer's luncheon, said that he did not think that the scheme would succeed; he did not think that any large number of returned soldiers would settle on the land. His ideas are in the direction of industrial development. Still I believe that a scheme, well managed, well conceived, by which a man could secure a fair living by a moderate amount of work, ought to produce good results. It should be managed by men conversant with the work and Dominion Land Surveyors are the only men fitted for the task.

The Chairman.—I think the Surveyor General has suggested a very feasible plan that might be worked out for the surveyors' benefit. I am sure that I should be very pleased to see the Association take this up. Now, any remarks in the way of new business or any remarks on what the Surveyor General has been good enough to tell us are quite welcome.

Mr. Fawcett.—I, for one, can testify that Mr. Adams' suggestion with reference to selecting the better parts of the country to be surveyed in the first place is not new so far as our Surveyor General is concerned. I think it was about eighteen years ago, the Surveyor General's policy was to have the country examined before surveying parties were sent and the examinations went to show what parts were to be selected and settled. There are parts of every country which are indefinitely conserved for timber, in order to protect the rivers, etc., the streams from, overflowing and only the examination of the country before the surveys are made has helped to determine what part of the country had better be left. His recommendations in reference to surveyors being the best qualified to select land for settlement by soldiers or others I think would recommend themselves to everyone. Last night, he brought it out pretty strongly before the Minister and before all our powerful friends. I think we are much indebted to the Surveyor General for the manner in which he has brought forward those advanced ideas.

Mr. Shanks.—This subject might be referred to a committee for special consideration.

The Chairman.—A very good suggestion, indeed.

Mr. Seymour.—I had in view the formation of committees such as suggested by Mr. Shanks, and I think that it would be well to appoint a special committee for the welfare of surveyors, a publicity committee or some other committee that might take up the suggestion dropped by Mr. McArthur at our first meeting and give the people at large an idea of the work done by surveyors. A great deal could be done in magazines and papers to show what we are, what we can do, what we have done and what we are doing. I think this committee could deal with the scheme suggested by the Surveyor General. Would it be in order to deal with the selection of such a committee at this time? I would like to see the subjects of topographical surveys and town planning investigated; it is not necessary that we should adopt them but I think we should investigate them. Also, I would like to see a committee on membership.

Secretary Hubbell.—Mr. Chairman, the proposition suggested by the Surveyor General appeals to me. I have lately been attending meetings of returned soldiers and listened to their views in connection with the scheme of land settlement. From what I can gather, I do not think that twenty per cent. of the returned soldiers will take up land, however, conditions may alter their present opinion. In accordance with the speeches delivered at the banquet last night, it might be advisable for a delegation of surveyors to present their views on this subject to the Minister. I strongly advise the appointment of a committee to follow up this important matter, which, if successful, will signify a whole lot to surveyors in general.

Mr. Akins.—I think the idea of a committee is the only solution because if it is left to individuals they think only of themselves and nothing is done. I suggest that such a committee have a director of strong personality in this capacity; I would like to suggest Major Hubbell. Some other members may name others whom they think may be good enough to act on a committee of this kind.

The Chairman.—Any further suggestions, gentlemen? This is a very interesting development for land surveyors which means either work or no work for the future.

Mr. Shanks.—In order to save time and to get something definite done, it might be well to leave the question to the general committee, it is not a large committee; Major Hubbell is a prominent member of it and will give us his assistance. If it is found necessary to form a new committee or to enlarge the old one that could be provided for.

A Member.—Mr. Shank's idea is a good one. I would like to see the executive committee add to their numbers or appoint a special committee to take up this matter and take it up at once, and put something definite before the Association. Large bodies move slowly. I think if you could get a smaller number of men who could give their attention to the matter, it would be better for the Association.

Mr. Seymour.—Will the committee take up all these matters?

The Chairman.—Mr. Shanks, I think that is the idea, is it not?

Mr. Shanks.—Yes, take them all up.

Mr. Seymour.—Before we hear the discussion on Mr. Narraway's paper I would like some surveyor to make a motion in regard to the mound. As you know, in my paper I expressed the hope that we might do away with the mound. I think the Association should go on record in this matter.

Mr. Norrish.—I would like to move, that in the opinion of this Association it is deemed desirable to abolish the use of mounds in connection with all monuments of Dominion Lands, except in connection with witness monuments, or in those cases where on account of rock or other obstacles it is impracticable to dig pits.

Mr. Cote.—I second the motion.

Secretary Hubbell.—Does that also include the abolishment of stone mounds?

Mr. Norrish.—I believe that where it is not possible to dig pits the stone mound should be built. If it is preferable, I would put the motion in writing.

A Member.—I think there is some kinds of soil where the pits are buried shortly after they are dug and the only resulting monument left would be a mound. I had occasion this year to dig pits in a marsh, shortly after a windstorm came up and the pits were filled in after half an hour. There was no mark left whatever of that monument I erected there in the case of pits. In the case of sandy soils, these pits fill in almost immediately. I have found cases this year of old work where the only thing I could find was a mound, and I think this should be left to the judgment of the surveyor.

Mr. Seymour.—I think there is of course much to be said for the mound but much more against it. I know there are some cases in which the mound would be useful, but considering the majority of cases, I believe that the mound should be abolished in the bush as it has been on the prairie.

Mr. Fawcett.—In retracing old lines in search for lost monuments in all parts of the Northwest, I have seen places where lines had been cut and where the timber had been entirely destroyed and a new growth came up again, so that not a part of the old timber remained. Nothing could be seen to show that the line had been run, and when you come to a locality like that, it is of great advantage to find the mound. In some cases, when I was near the corner, I fell in the pits. I suppose Major Hubbell, in his inspections, has often come across cases of that kind.

Secretary Hubbell.—Yes indeed.

Mr. Fawcett.—And more than that, in districts that had been timbered and surveyed and not marked by mounds, where the timber had been destroyed by prairie fires, you could not find a single mark in the whole locality to show that the survey had been made, all you could do was to make a survey over again. I think in abolishing the mound to get over the trouble that Mr. Seymour sees in carrying the earth a long distance, we may create greater difficulties.

The Chairman.—We will now have the discussion of Mr. Narraway's paper.

(Mr. Narraway reads his answer to questions).

SUGGESTED CHANGES IN THE METHOD OF SUBDIVIDING TOWNSHIPS. (Second Paper).

A. M. Narraway, D.L.S.
Dept. of Interior.

The paper I read before you on Wednesday afternoon was prepared and read for the purpose of having you point out any defects, and also for the purpose of receiving any suggestions.

About a week and a half ago I outlined this method to each surveyor personally, whom I was able to reach in the city, and asked them all to consider the matter thoroughly and apply it to any of the work they had been connected with during their experience on subdivision, and to let me have their opinions and suggestions. I asked, most particularly for an expression of their views as to whether or not they considered the scheme advantageous to them in the field, and whether or not it was sufficiently beneficial to warrant a change from the present system.

Without exception these surveyors, in their replies, expressed their entire approval with the main points of the scheme. They emphasized that it would give them greater liberties of action in dealing with each township in an accurate manner, and without greater cost or more labor. The only point they were not clear on was just what should be done when the central control line was not on true bearing. Most of them favoured deflecting at the nearest section corner to the point at which they discovered their line to be out. However, as I pointed out in my paper, this might tend to complicate any future surveys and should be avoided if possible. I therefore chose this question as one that should be discussed at the meeting.

I would point out here that these deflections are not peculiar to the method I have outlined, but have been met with in the present surveys throughout with the same difficulties.

These surveyors all agreed that any method that would do away with the offsetting, especially off line, would in itself be a great saving of time and error.

I was glad to make note of the various points raised as they helped to bring the method before the members of the Association more clearly.

Mr. Lonergan has asked which meridian you should choose as a control meridian on the other side of the correction line if you do not choose the central meridian at first.

The central meridian is always preferable, but if it is not practical to run it then another meridian is chosen. But if such a departure is made, it is confined only to one side of the correction line and the other side must be considered as a separate problem.

He also asks what should be done if the central meridian is true in bearing for the first six miles and goes out in the last six:

The deflection error is carried across the township to the correction line.

Mr. McGarry asks if the township corners would not be incorrectly established if the central meridian reached the outline in error and this corner was established at theoretic chainages:

This is a serious difficulty in the present system as the township corners are placed on the township outlines which are not to be deflected, and if any error enters it determines directly the position of the township corners. With the proposed system so much care is taken to ensure an accurate determination of the azimuth of the control meridian that the error in the position of the township corners established from this line, by theoretic chainages or by intersection, should be small and therfore can be noted but not corrected.

A member prefers the central chord of the township to the township outline as a control chord. This is certainly the best line to run from the point of view of accuracy, but it may not be the most economical line to run, because it may leave so many outlying portions of line to be run which are scattered, and which do not furnish a full day's work for the axemen without a considerable wastage of time in walking. This will have to be worked out in practice.

Mr. LeBlanc prefers placing the quater monument midway between the section corners:

This of course, reverts back to offsetting, and doing away with the offsetting is one of the main points of the new system. Offsetting should be done by the transitman and the chainers, but these men cannot spare the time, therefore it is too often left to the mounder and many mistakes creep in.

Mr. Watt states that with this new method in force, one set of chainmen would do the work better than two:

This would certainly be the case in the average country were it not for the lining in of the posts by the transit. These posts cannot be satisfactorily lined in after the transitman has moved away. Therefore two sets of chainmen are necessary to keep pace with the line parties.

I will be glad to discuss further any other points that may be brought up by any of the members, either here or privately after the meeting.

Mr. Watt.— In the present system the method of survey is strictly defined, but the system is so flexible that although it is stated in the act that the outline is to be run first, the system is so flexible that the subdivision may be commenced at any point on an outline and the other outlines left to the very last without affecting the system in any way. This flexibility is a very great advantage in attacking a difficult township and I think the want of it will be felt under the proposed system.

Mr. Fawcett.—I have always thought that the question of how you could survey a township the most economically is the question that you would take up. In going into a new territory, the object is generally to make a survey with as little expenditure as possible, because you have to cut roads to move your camp in the woods and that is a very expensive thing. I have found it generally the most economical if you could put your camp up at four points in the township. At the first point you survey all around your camp, then you install your camp miles further and do the same, until the survey has been completed as you go on.

Mr. Watt.—I believe that three camps in two townships is best. I found the quickest method to be as follows. In two townships, one north of the other, run the central meridian first and camp at the intersection of the chord two miles up. As it is almost impossible to start a number of meridians from a base line that has been cut more than two years, and have them on anything like theoretic bearings, run this chord across the township as a straight line and use it for a base, running the meridans north and south from it. All the work lying within two miles north and south of this camp was completed and then a move made four miles up the central meridian to the next camp at the north boundary, and so on, moving four miles at a time. To keep the camps right at the corner of the two lines was a saving in many ways—camp could always be found, mounders could be more easily directed to work, and it saved walking. If there was no creek near, a well was dug. One man will dig a well four feet by four feet, and six feet deep and cover it with a platform in one day—even in winter. The advantage of clear, cold water at all times, especially on a hot day in fly time, is much appreciated by everyone, and well worth the cost.

The same assistant and his party should always be kept on the one side of the central meridian, even in succeeding camps; this proves to be a great saving in time and leads to a friendly rivalry between the parties which is not racing, but tends to keep the men up to their work, and assistants see their men away more promptly in the morning, keep the tools in good shape, and are not so ready to quit work during the day unless for good reason, and as they become acquainted with their district, plan their work to the best advantage.

As to the question of deflecting the central meridian, if I were to find it in error I would prefer, unless the error were large, to run it as a straight line through the township.

A MEMBER.—Suppose you are up two miles on your line, Mr. Watt, and you are off one minute, what would you do?

MR. WATT.—I would not change for a minute, I would run through six miles anyway. I would not deflect in the township. I would deflect at the boundary and run on theoretic bearing from there.

SECRETARY HUBBELL.—The surveyor on subdivision work generally camps three places in a township. Most surveyors run a central meridian right through; it makes a good trail for transportation for the twelve miles, and can be used as a pack trail and from which they can travel all around. It seems to be satisfactory.

DR. DEVILLE.—Do you move the camp every two miles?

MR. WATT.—No, every four miles; survey two miles on each side of the camp then move the camp four miles.

MR. SEYMOUR.—I think on the main point of this system, that is as to the advantage of the method of intersections, we all agree. It is undoubtedly an improvement over the old system. But the simplification of calculation depends on the central line being straight.

MR. AKINS.—I think the central line should be run just as exactly as the base line. It is possible that the surveyor himself could go ahead and make observations there for a couple of days. I think if you were eight minutes out and you produced that line three quarters way through the township without taking any observations, you will have a funny lot of townships.

MR. BLANCHET.—I should think that this system depends on a straight line. I should deem it advisable that if there is a mistake, the correction should be made.

Mr. Watt.—One thing about this system. The outlines are not run through as in the old system. I would like to see the outline run out straight.

Mr. Akins.—I should think the chain correction should always be recorded. In that connection we should go out in the spring with a chain tested by the laboratory and use it.

Mr. Norrish.—The subsidiary standard though accurately tested at the laboratory is only one chain in length, whereas chaining is done with four or five chain tapes. If we had a four chain tape tested at the laboratory we could use it to better advantage.

Mr. Blanchet.—The trouble with the four chain tape is to keep it off the ground. The one inch standard is easily kept off the ground.

Mr. Seymour.—I think this would be a good subject to appoint a committee to investigate or on which to have a paper prepared. I am afraid a great number of tapes were not tested at all.

Dr. Deville.—I would like to bring out a few points which were not touched upon. The surveys are being made for the men who will own the land. Our aim is not to make a theoretic figure which is accurate in shape or of a precise dimension. We want to make a survey to meet with the requirements of the men who will own the land, and to them it will not matter if the land is exactly a square or if it contains exactly 160 or 161 acres; that makes no difference so long as they know exactly what they are getting. It would not meet their requirements to get a piece of land containing 159 acres if they are led to believe that it contains 160 acres, but if the plan and measurements show that it contains only 159 acres, they will have no fault to find. You have to bear in mind that we are making surveys for practical purposes. If this system meets with the requirements of the land owner better than the old system, let us use it by all means. The system, as far as I can see, ought to work out well enough. It would keep everything straight in each township. A point on which I wish to insist is this: it is not necessary that a section should be 640 acres, that is not essential at all. What is essential is to know exactly the dimensions of that section.

The Chairman.—We are very much obliged to the Surveyor General for this very important suggestion that he has given us. Have you anything further to offer on this matter, gentlemen? We will present this motion to you; after this will be the adjournment of the last meeting.

(Moved by Mr. Norrish, seconded by Mr. Cote, that this Association place itself on record as advising the abolishment of mounds. Major Hubbell has this motion, I believe, in writing). Carried.

There seems to be nothing further now and I will adjourn the meeting. I want to thank the gentlemen who have attended the meetings. The committee will approach you on different matters and I am sure that you will all help to make this Association better, if possible. Unless there is something else to be offered by the members, this meeting will stand adjourned.

Meeting adjourned.

FIELD WORK OF THE TRIANGULATION SURVEY OF THE RAILWAY BELT

M. P. Bridgland, D.L.S.

The Railway Belt of British Columbia consists of a strip of land forty miles wide, extending twenty miles on each side of the Canadian Pacific Railway throughout that province. When British Columbia joined the Dominion of Canada in 1871, the Federal Government agreed to commence the construction of a transcontinental railway within two years of the date of the union, and to complete the road within ten years. In return the tract of land designated as the Railway Belt was transferred to the Dominion by the Government of British Columbia.

Objects.

Owing to the mountainous nature of this district, it was impossible to lay out upon the ground, base lines and meridan lines in comformity with the huge rectangular system of survey in use on the prairie. Moreover the lands required for settlement were, for the most part, small areas along the valleys, and surveys of these were necessarily of an isolated nature. Mining claims and timber limits were even more difficult to reach. Consequently as a base for future surveys, an accurate traverse of the Canadian Pacific Railway between the Fifth Meridan and the Coast was made. This work was done by two parties, one starting at Calgary and the other at Port Moody. When the two parties met at Revelstoke, a discrepancy of 20.62 chains in latitude was found to exist between the two traverses. This difference, which appears to be due largely to local deflections of the plumb-bob has been compensated by allowing a corresponding jog to the north of the 6th meridan. But even with this survey as a base, many long tedious miles of expensive traverse through country so rough that a high degree of accuracy was impossible, were necessary to reach the outlying districts. Naturally this system was not satisfactory, and in order to establish accurately known points throughout the belt from which new surveys could be commenced and the accuracy of old surveys checked, the triangulation survey was inaugurated.

Moreover it is obvious that the boundaries of the Belt as defined by the section lines most closely approximating the theoretical limits, are very difficult to determine, not only on account of the distance from the railway, but also on account of the rough nature of the country across which the lines must be carried. For this reason points were established in the vicinity of the twenty mile limit whenever it was possible to do so without serious delay.

This survey serves another very important purpose. The country covered by the triangulation is extremely rough, including high snow-clad mountain ranges, ten thousand to eleven thousand feet above sea level, where ordinary methods of survey are impossible. In order to map these districts, extensive photographic surveys dependent on a secondary triangulation have been made. This triangulation, necessary for the location of photographic stations, is of a reconnaissance nature, and is carried on simultaneously with the photographic work, the angles being read with a light three inch mountain transit. For this work, the primary stations furnish an accurate and very convenient base, and by using them as a control a high degree of precison for that class of work may be obtained.

Progress and General Description.

The triangulation was first placed in charge of Mr. W. S. Drewry who began work in 1889, and continued it during the three following years. Mr. Drewry commenced work near Morley, Alberta, and worked westerly throughout the season. During the fall, a base about a mile and a half long, was selected on the flats west of Cochrane, and was expanded to a side of the main triangulation by means of intermediate stations. This base was measured with a steel tape 66ft. long, stretched to a constant tension of 20 pounds by means of a spring balance and the result corrected for temperature and slope. The next year the work was continued eastward to connect with the fifth meridan near Calgary, and westward to the summit of the Rocky Mountains. During these two years, a chain of simple triangles was used, but west of the summit it was decided to carry on a double system of triangles, in order to cover more thoroughly the territory within the Belt, much of which at that time was unexplored. In the two seasons following Mr. Drewry established signals westward to beyond the summit of the Selkirk Range, while his assistants completed the instrumental work as far west as Mt. King, in Township 27, Range 19, West of the Fifth meridan. No angles were read beyond this point and none of the stations were permanently marked. Mr. Drewry's completed work included 18 primary stations, and covered a tract of country about one hundred miles long and about twenty miles wide, lying along the main line of the Canadian Pacific Railway.

The following years Mr. Drewry was engaged elsewhere, and during the period of widespread depression, which occured about that time, nearly all demand for surveys within the belt ceased. Government expenditures were curtailed also, and the triangulation was dropped for a time. About ten years later the outlook became brighter and the increasing prosperity of the following years caused a revival of all industries, agricultural, mining and lumbering, within the Belt, with a corresponding increase in the demand for further surveys. Consequently in 1906, the triangulation was recommenced by Mr. P. A. Carson, who was instructed to begin work where Mr. Drewry left off and to continue it westward.

In that season, Mr. Carson picked up the old work near the summit of the Rocky Mountains, and during that and the three succeeding years carried it westward to beyond the summit of the Selkirk range. In addition to the primary stations, a number of secondary ones were established, so that the railway Belt between the two ranges was thoroughly covered. The instrument work was completed and all stations occupied were permanently marked This work was controlled by a base in the Columbia valley, about twenty-five miles above Golden. This base, which was over five miles long, was admirably situated with respect to the triangulation and was expanded to one of the main sides by means of three secondary stations. In 1909 it was accurately measured by invar wires, and a full description of the wires, the methods of measurement, and the result obtained may be found in Mr. Carson's report for that year. This has been published in pamphlet form also.

In 1910 the writer was placed in charge and carried on the work for three successive years. The triangulation was continued west to Salmon Arm, and a second base five miles long was laid out in range 10, west of the 6th meridan. This base was also measured by invar wires, using the same wires and methods as Mr. Carson. In addition to this work, a number of stations throughout the system were connected to existing posts of the Dominion Land Surveys.

During 1912, an attempt was made to locate Mr. Drewry's old stations near the Fifth Meridan. This was partially successful, and three out of the first six were found. The others were re-established in their probable positions and the angles connecting them re-read. An effort was made to find the old base near Cochrane, which had been marked by iron posts two inches square, driven three feet six inches into the ground with only two or three inches above ground. The post at the east end was found without difficulty, but the one at the west was missing. Even had it been found, it is doubtful if a re-measurement of the base would have been of value, for a man living near admitted that he had hit the post at the east end a few times with a sledge but had been unable to get it out. This furnishes an example of the wisdom of using underground marks.

In 1914 instructions were received to retrace all of Mr. Drewry's work and to permanently mark all stations not previously marked. With the help of the old angles, no difficulty was experienced in carrying out this work. A comparison of this work with the old triangulation shows a difference of about $\frac{1}{20000}$ in the lengths of the sides, computed from the Cochrane base and the lengths computed from the Kootenay base. This is most probably due to an error in the length of the tape used by Mr. Drewry, a probability pointed out by him in his report of 1889.

As previously stated, from the Fifth Meridan to the summit of the mountains a chain of single triangles has been used. This is the most rapid method of covering the linear distance between two points, but does not embrace a very wide area within its lines. It is also the simplest form of triangulation, involving only the geometrical condition that the sum of the three angles of each triangle be equal to two right-angles plus the spherical excess. Further west use was made of five or six sided polygons with a central point, all directions being observed. While this system is not as strong as a series of quadrilaterals, it is much more accurate than simple triangles and in proportion to the number of stations (assuming the sides of the triangles to be approximately equal) includes a much greater area within its network. The closed figures introduce two geometrical conditions, first, the angles of each triangle must equal two right angles plus the spherical excess, and second, that the length of any side computed from the known side must be the same whatever the route chosen.

The lengths of the sides of the triangle varied a great deal owing to the nature of the country, but as a rule, were from fifteen to twenty-five miles long. The shape of the triangle depended only on the rule that no angle of any triangle should be less than thirty degrees. This rule was rigidly observed throughout except in the case of diagonals of quadrilaterals where such a condition would be impracticable. Another rule was that the closing error of any triangle should not exceed eight seconds. This rule, which was carefully observed also, caused very little trouble and the average closing of all the main triangles was about three seconds.

The result of the whole work is a continuous system of triangulation extending from the Fifth Meridan near Calgary to Salmon Arm, in Range 10, west of the Sixth Meridan, a distance of about 240 miles in longtitude. This entire system is controlled by the two bases, one in the Columbia Valley and the other near Salmon Arm. About seven thousand square miles are covered by the survey and throughout this area, 46 primary points have been established and permanently marked. In addition, some twenty-five secondary stations have been established with only a slight degree less accuracy. Dominion Lands posts connected with the survey are not included in this number. The length of the Salmon

Arm base, computed from the Kootenay base, 120 miles distant, differed from the measured length by about six inches. This represents a discrepancy of less than $\frac{1}{50000}$ which compares favorably with the highest class of secondary triangulation. Errors of measurement in the base lines are thought to be too small to have any material effect on the results of the work.

Marking of Stations.

The stations are marked by a brass bolt six inches long and half an inch in diameter with a head one inch square. The head was stamped with a triangle, the apex being at the centre. The bolts at most of the stations were stamped also with the number of the station in Roman numerals, but during the latter part of the work the letters, T.S. were used instead. Three or four iron reference bolts were placed nearby and their distances and bearings from the station carefully noted. All bolts were placed in holes drilled in the rock, apparently solid rock being selected wherever possible. At the eastern end, the bolts were placed in cement about two and a half feet below the ground and one or more thirty-inch iron posts driven in near by as reference marks.

Signals.

The signals used on the rocky summits were cairns four to five feet in diameter and six to nine feet high. A band of white cotton was placed around the cairn near the top and carefully secured with wire. It was found that even when the cairn stood on sky line this was sometimes of assistance, and when it showed against a dark background the cotton was a necessity. Cotton placed on a cairn one season could usually be distinguished during the following season. The tin cones placed on the cairns in the beginning of the survey were found unsatisfactory and were discarded. On the lower hills where wood was available, wooden signals having four supports and a heavy centre pole nine inches to one foot diameter were constructed. The top of the pole was left three to five feet above the apex of the supports, and the bottom three to four feet below. Both centre pole and supports were then securely braced and slabs nailed to the supports for about three feet below their apex. White cotton and black sateen were then tacked on securely. These signals were constructed of dry timber and will last for years.

The sides of the wooden signals were placed as nearly as possible at right angles to the different lines of sight and the supports placed so as not to interfere with the lines. The signals were made large enough to permit of using the instrument underneath without disturbing them, thus saving much valuable time. Moreover, a blanket or a piece of canvas could be stretched around the framework in a very few minutes, forming a most efficient protection from the sun and wind for both instrument and observer.

One cause of error in the work is due to phaze or uneven illumination of the signals, and it seems very difficult to devise a signal which is entirely free from that fault when observed from different directions. Of the signals above described, the only one practically free from phaze is the cairn when seen against the sky line. In the other cases, when the atmosphere is clear and the light steady, sufficient detail can be seen to avoid any appreciable error. Under more unfavorable circumstances, it is thought that by a careful pointing of the telescope and by taking readings under different conditions wherever possible, any serious error has been avoided. Even in extreme cases, the greatest possible error arising from this scource would seldom exceed one second, and by täking the above precautions it has probably been kept much less.

The Instrument and Measurement of Angles.

The instrument used throughout was a direction theodolite made by Messrs. T. Cooke and Sons, of York, England. The telescope had a focal length of 15.5 inches and the objective a clear aperature of 2 inches. The horizontal circle was six inches in diameter, and the readings were made by two micrometer microscopes of high magnifying power, with two parallel spider hairs. These micrometers were attached rigidly to the standards.

Prior to 1913, the horizontal circle was graduated to 0.25 degrees. Five revolutions of the micrometer corresponded to one division of the circle and therefore one revolution was equal to 0.05 degrees. The milled head of the micrometer was divided into fifty divisions, each division being equal to 0.001 degrees or 3.6 seconds.

At the end of 1912, the horizontal circle was regraduated and divided into 5 minute spaces. Two revolutions of the micrometer were made to correspond to one division of the circle, each revolution being equal to 2.5 minutes. The drum of the micrometer was divided into thirty divisions of 5 seconds each and graduated to read minutes and seconds direct. By interpolation, angles could be easily read to the nearest second. The instrument, in this form, was used for checking the eastern end of the triangulation in 1914, and the new system of graduation was found very much more convenient than the old. The speed of reading angles was greatly facilitated by having only two turns of the micrometer to one division of the scale instead of five. Morever the work of calculating the final angles was reduced to about one third of what it was with the former system.

Vertical angles were read by means of a four inch circle rigidly attached to the axis of the telescope. This circle was graduated to 30 minutes and angles were read to minutes by two opposite verniers controlled by a small level above and parallel to the plane of the circle. The value of one division of this bubble was 15 seconds. When reading angles the position of both ends of the bubble was recorded and a correction applied in the office.

The instrument was mounted on a short, strongly built tripod, rigidly braced by cross-pieces screwed to the legs. Where possible, holes were drilled in the rock to receive the points of the legs, and in high winds the tripod was further braced by rocks placed in a bag between the legs. The whole instrument, packed in three cases for convenience in carrying, weighed about sixty-five pounds.

Horizontal angles were read by the direction method, closing again in the initial point. Usually the initial and final readings agreed closely and the mean was accepted as correct, but if the difference was excessive, the set was rejected and re-read. The first set was taken with the initial readings approximately 0° and 180° and the telescope was turned to the right throughout; the telescope was then taken out of the wyes and reversed, and a full set taken in the reverse direction always approaching the signals from the left. Care was taken at all times to turn the tangent screw against the spring in order to avoid possibility of lost motion. A least four pairs of such sets of readings were taken with the initial readings approximately 0°, 45°, 90° and 180°. Where time permitted additional readings were taken. Where one or more signals were hidden by clouds, they were omitted and supplementary sets taken later.

Theoretically the micrometer is adjusted so that the nominal number of turns (five in the first instance, or two in the second) will move the hairs exactly across one division of the graduated circle. This adjustment is made by moving the microscope farther from or nearer to the graduated circle thus altering the magnitude of the image as seen in the field. If a whole number of revolutions is greater than the image of a division of the circle, the whole microscope must be brought nearer to the circle; if less it must be moved farther away. In the triangulation instrument, no means was provided for altering the position of the objective, so that the only other adjustment was that of the eyepiece which could be moved in or out to avoid parallax. Owing to imperfections of manufacture, such as errors of graduations, and lack of parallelism between the plane of horizontal circle and the plane of revolution of the microscopes, and to constant temperature changes taking place in the instrument, the ideal adjustment is never realized.

To avoid this trouble, the micrometers were adjusted as nearly as possible to a mean position at the beginning of the season and this was checked occasionally to see that no serious change had taken place. When setting on the initial point the zero of the micrometer was advanced over a fraction of a circle division corresponding to the number of readings to be taken. For example, if five turns of the micrometer corresponded to one division of the circle and four readings were to be taken, the first reading was made with the micrometer at zero, the second with it advanced $1\frac{1}{4}$ turns and so on. This gave a uniform division of the readings upon each of the other objects sighted on, so that the average of the micrometer readings upon each object was nearly the same, and the correction for error of run for each angle disappeared. Care must be taken throughout to see that the screw is turned against its spring in order to insure a uniform motion.

In practice the greatest difficulty experienced by the writer was due to non-radial illumination of the graduated circle. If one side of the graduation was more strongly illuminated than the other, it caused an error of 3 or 4 seconds in the reading. To avoid this the instrument was sheltered from the sun whenever possible and the divisions were always shaded when reading. To avoid mistakes, both micrometers were always read twice, the position being changed between readings, and the mean of the result accepted.

It will be noticed that by using the above methods the accuracy of the resultant angle has been made to depend, not on the accuracy of any one measurement, but on the combined result of the whole set. Instrumental errors and errors of adjustment have been eliminated by a systematic repetition of the angles. The effect of accidental errors, such as that due to incorrect pointing of the telescope or reading of the micrometeres, has also been much reduced.

Azimuth Observations.

The method used for Azimuth observations was the same as that described in section 272 of the Manual. The order of procedure used in observing was as follows: The instrument was first carefully levelled, using the striding level, and an initial reading made on the reference object. The telescope was then unclamped and set on the star, and the level read in both positions; then the micrometers were read. The telescope was again set on the star, the striding level and the micrometers re-read and finally a closing reading was made on the reference ob ect. The telescope was then taken out of its wyes and reversed, and a corresponding reading taken in the reversed position. As in the case of horizontal angles, readings were taken in at least four positions and the same precautions observed in turning the instrument to right or left, turning tangent screws against their springs, and changing the position of the micrometers.

Generally the approximate azimuth of the reference line was known, or if not it could be easily determined by means of the ordinary field tables. Time was then determined by observing the transit of one or more stars across the meridian, about the time the observation was taken. For this purpose the list of stars given in the field tables was used, though towards evening much delay was sometimes saved by using smaller stars given in the Nautical Almanac. When possible the star was observed 30′ east, on the meridian and 30′ west. The angle between the assumed meridian and the reference object was recorded, thus allowing any error in azimuth or in turning off the meridian to be corrected later.

The striding level accompanying the instrument was fitted with a wooden handle so that it was not necessary to touch any of the metal parts. The tube was graduated from the middle toward the ends and when the bubble, which was adjusted by means of an air chamber at one end, had a length of 16.5 divisions, one division of the tube had a value of 3.3 seconds of arc. The eye piece used by the writer was the one used for ordinary work and had a magnifying power of about thirty diameters. With it Polaris could be seen easily througout the whole day if the atmosphere was clear. A more powerful eye piece was supplied but it appeared to increase the apparent refraction and was not used.

Usually the observations were taken at a primary station using another primary station as reference object. The striding level must be protected from the sun and for satisfactory results the instrument should also be protected. If possible both should be sheltered from the wind, as even a slight breeze has a tendency to affect the delicate adjustments of the level.

Refraction.

Throughout all the work, refraction was found to be one of the hardest obstacles to overcome. The objects of the survey were purely practical and time did not permit of long delays for suitable atmospheric conditions, so angles were read whenever it was possible to do so with a reasonable degree of accuracy. At the lower stations, observations near the middle of the day were avoided, except in cloudy weather, and in some cases it was impossible to see the signals in the morning after 8 a.m. or before 5 p.m. On the higher peaks there was no choice, and all the time availab e for observing had to be used to the best posssible advantage. Fortunately, at high altitudes, the refraction was not nearly so bad as lower down, and signals could be seen reasonable well even in the middle of the day, particularly if the line of sight d d not pass close above intervening ridges or high snowfields. Vertical angles were read near the middle of the day as vertical refraction has the least effect at that time.

General Remarks.

The party consisted of the surveyor in charge and five men, and for transport were dependent on a pack-train of eight horses. For the greater part of the season, the party travelled as light as possible carrying neither stove nor cook tent. This arrangement was very convenient for fine weather but a little disagreeable in protracted spells of rainy weather. Tents made o Egyptian silk were used. These turned water well and on account of their light weight, were a negligible factor in the packing. When peaks some distance from the existing trails had to be reached, instruments, tents and supplies were packed in on foot, no light task in the heavy undergrowth of the Selkirk Range.

One serious difficulty was the lack of time on high peaks where the ascent required four to six hours in the morning and the descent at least two to three hours in the evening. Under the most favorable circumstances three hours were required to set up the instrument and read a set of angles on five signals, and the surveyor was fortunate indeed if his work was satisfactorily completed in five hours. Any delay due to clouds or indistinct signals added to his difficulties. In order to offset this, camp was nearly always taken to timber-line below the peak on the day preceding the ascent. Not only did this permit of more time for observing, with greater opportunity to select favorable conditions, but by relieving the observer of the fatigue of a long and ardous climb, it left him in a better condition for his work.

It is perhaps hard for those who have had no experience with this class of work to realize the extent to which the surveyor is at the mercy of the weather and atmospheric conditions. During the season of 1911, a light camp was taken to timber line on Mt. Begbie. It was a beautiful day and the party confidently expected to complete the work the following day. About four o'clock a thunderstorm suddenly rolled up from the west, and the ascent of Begbie was made two weeks later in eighteen inches of fresh snow. If the weather throughout the season is dry, similar delays are sure to be caused by smoke. The reports of Mr. Drewry and Mr. Carson show that every season much time has been lost through one or both of these causes. As the season available for work at high altitudes is only about four months, such delays impede progress very seriously.

For further information on this subject anyone interested is referred to "The Triangulation of the Railway Belt of British Columbia" by Mr. H. Parry, a report recently published by the Department, which gives a full description of both field and office work with the results in tabulated form. A still more complete description of the invar wires and the methods employed for measuring the base lines may be found in Mr. Carson's pamphlet, "Precise Measuring with invar Wires and the Measurement of the Kootenay Base."

THE SHORT PICKET METHOD OF RUNNING SURVEY LINES.

By E. L. Burgess.

On the last two visits of Inspector Loungan, I have understood that it is the policy of the Department to make a study of the actual survey operations employed by surveyors in the field, and to endeavour to standardize methods after deciding which method is the most suitable for various parts of the country. In my opinion, too little attention has been paid to this matter in the past, and the action of the Department in this respect is commendable. It seems to me that the accuracy of surveys could be increased by informing surveyors of the best known methods of performing such simple work as taking points from the transit. It is true, that one can learn to run a line only by running it, but rapidity and accuracy will be increased by an intelligent study of methods and the sources of errors.

So far as I have observed, there are three methods of taking transit stations in running a straight line.

On the prairies and other comparatively level country, the picketman prepares a smooth place on the ground, and with the use of a colored picket takes two points from the transit by making small holes in the ground with the point of the picket. Small wooden plugs, about three inches long, may or may not be inserted in the holes made by the picket point. This method, which, with minor modification, is practically in universal use in the three prairie provinces, is suitable when stations are generally more than ten chains apart. In British Columbia, where the average distance between stations is about five chains, other methods have to be employed.

The attempt of some Dominion Land Surveyors to transplant the methods of the prairie provinces to British Columbia, has resulted in much very inaccurate work being done. The name of more than one surveyor could be mentioned whose work on the prairie is above reproach, while that done in B. C. does him anything but credit.

The method of taking transit stations most generally used in B. C. is merely a refinement of the methods used on the prairie. The picketman, when ready to take station, first obtains line approximately and then drives a hub firmly into the ground at that point, and in such a position that the two reverse points from the transit will fall on it. The points are taken by the use, not of a red and white picket, but of a plumbbob. When the distance is so great that the transitman cannot distinguish the plumbbob line, he sights at the target which is always carried on the line. After the two points are taken, a tack is driven midway between them for the use of the transitman. This method is much used in British Columbia. Its universality is indicated by one or two facts.

Nearly twenty years ago a manual was issued for the survey of mineral claims in B. C. which contained instructions that the notes should give the positions of all hubs planted and that copper tacks should be used in the hubs. For some years past, B. C. land surveyors have been expected to show the positions of all transit stations in their notes of land surveys, by writing the word "hub" opposite the chainage to the transit station.

The method which will now be described, and which for the want of a better name is called the Short Picket Method, has been in use in the Railway Belt of British Columbia for many years. It was used exclusively by Joseph E. Ross, of Kamloops, from about 1896, and by his pupils, including A. W. Johnston and J. A. Calder, as well as by C. H. Taggart. The excellence of the work performed by all of these men is a matter of common knowledge to the Department.

When ready to take station the picketman prepares a fine pointed picket of such length that it will project three feet above the surface of the ground when planted. After signalling to the transitman, that he intends to take a station, he takes a line approximately and makes a hole as deep as possible in the earth with his picket. The station picket is then inserted firmly in the hole, and the earth firmly compacted about it by means of the end of the axe handle, or the picketman's heel. It is essential to the success of the method that this operation be well performed. The picket must be secured so firmly in the earth that it will spring back to place if pressed slightly to one side.

The transitman now gives a signal for the picket to be moved exactly on the first line of sight. The picket is moved by pressing it firmly to one side with the hand and packing the earth firmly behind it with the heel. The transit is now reversed and the second sight taken, which in general will not fall exactly on the point of the picket. The next move usually made is to signal the picketman to move the picket half way over to the reversed position of the transit. A disadvantage of this procedure is that it is difficult for the transitman to carry the exact distance in his mind while the picket is being moved. The writer has made a variation in this method which is more accurate and more expeditous. After taking the reversed sighting with the transit, the transitman carefully notes the distance he has struck off the picket and while still observing the picket shifts the line of sight by means of the tongant slow motion screw until it comes half way over to the picket. By this means the bisecting of the distance is done in a second or two. The line of sight of the transit now corresponds exactly with the line being run, and the picketman is signalled to move the picket over to the line of sight. The correctness of the position of the picket should now be checked. The two pointings of the transit will fall on opposite sides of, and at equal distances from the point of the picket.

To obtain the best results with this method, it is obvious that the transit must be in close adjustment for collimation. The writer makes it a rule to keep the instrument adjusted so well that the two points taken in the reverse positions of the transit will not be more than the width of the picket apart at a distance of five chains. At a distance of one chain, the two pointings should almost coincide.

When this method is used it is a very simple matter to make the adjustment for collimation. The picket is placed on line with the first position of the transit. If the reverse pointing shows that the instrument is throwing off too far, make the adjustment by moving the line of sight three quarters of the distance towards the picket with the tangent screw, and then bringing the line of sight dead on the picket by adjusting the line of sight. The instrument should now be in adjustment. The forward picket has still to be moved to correct position, however. In most cases one operation by this method is sufficient to make the adjustment for collimation accurate enough to meet the requirement mentioned.

If the transit quickly loses its adjustment, there is a cause which can be removed. The writer experienced this trouble during the past season and at the suggestion of the Inspector, examined the object glass and found that the metal ring which held it in place was loose. It was tightened, and no further trouble experienced with the transit losing its adjustment.

The reading of slopes between transit stations is made very simple when the Short Picket Method is used. The slopes are read only at every other station, and are then read both forward and backward. This method of reading slopes, which I believe is practicable only with the Short Picket Method of running the line, eliminates about one half of the quantities to be recorded, as with it no H. I's (heights of instrument) are required, except in unusual circumstances. If slopes are all read forward, or in the direction of the line, a considerable error is introduced on account of the curvature of the earth. In a closed block of six miles, this error amounts to about four feet, being 8 ins. to the mile. By reading the slopes only at alternate stations and then reading them both forward and backward, this error is eliminated as in ordinary levelling.

In running lines over a mountainous country by means of the Short Picket Method, it is important to have the horizontal axis carefully adjusted, otherwise the care taken in adjusting the collimation is lost, for if the horizontal axis is out of adjustment, and the line of collimation is adjusted for level country, it will be found to be in error in giving points on a slope and vice versa.

In the mountains, excellent opportunities occur on the line for adjusting the horizontal axis. If one is on a slope facing another steep slope, it is possible to select points on the opposite slope having a range of 45° in altitude. The nearest point will be at a considerable distance from the transit, so that it will be easy to make the adjustment.

Care requires to be taken in levelling the instrument in producing a line either up or down a steep slope, if the transit is out of level by even half a division, the error in the position of the picket is quite perceptible.

Some of the advantages of this method which have not already been mentioned are:—

It is almost "fool proof" as far as the picketman is concerned. He cannot go wrong because the transitman sees exactly what he is doing at every move.

A new picketman easily learns what to do. This is of more importance on private work when the surveyor must train his picketman in his duties in a very short time.

The transit stations are fairly permanent and are easily found. The writer has picked up old lines that had been run seven years, and found the bearing correct within a minute or two.

QUESTION DRAWER.

1. The quarter section post in the north boundary of a section is lost. It was established in the original survey by running north from the quarter section post on the south boundary of the section. The north boundary of the section has never been run, but the northeast and northwest corners were established in the original survey. How should a surveyor proceed to re-establish the lost corner?

A PROPOSED D.L.S. SLIDE RULE FOR COMPUTING SOLAR ALTITUDE-AZIMUTHS

By W. H. Herbert, B.Sc.

From time to time calculating instruments are submitted for approval, such as the Ross Meridiograph and Keuffel & Esser's Surveyors' Duplex Slide Rule, which are designed for determining the azimuth from the latitude of a station and the declination and altitude of the sun.

In general these instruments possess many good points and would undoubtedly prove quite satisfactory for southern latitudes. However, they have not been so well adapted to Canadian lat tudes and, of course, ignored altogether the Dominion Lands system of surveys.

With the object of overcoming these defects it was proposed to design a special slide rule for computing solar altitude-azimuths.

This rule is shown to half scale in the accompanying plate where fig. 1 shows the face of rule and face of slide, fig. 2 shows the face of rule and back of slide and fig. 3 shows the back of rule with the dentification scale for finding Z.

It is the standard twenty-inch slide rule with special trigonometrical scales substituted for the ordinary number scales; and has been designed to calculate the exact horizontal angle from the true north to the sun, when the latitude of the observation station and the altitude and declination of the sun are known.

Let h = altitude of sun at time of obsevation.
" D = declination " " "
" Z = azimuth " " " (measured from the north to the south, in the east or west direction.)
" L = latitude of observation station.

Then the function of the rule, expressed mathematically, becomes:

$$\cos Z = \sin D \sec L \sec h - \frac{\tan h}{\cot L},$$
$$= A \quad - \quad B.$$

It will be noted that B is always positive, while A is positive or negative according as the sun is north or south of the equator.

The upper scale of the rule is a scale of tangents in two sections: the first section extending from 45° to 54°30′, and the second from 8° to 45°.

The lower scale of the rule is a scale of numbers extending from 0.1 to 1.0.

Upon the face of the slide, at the right hand end, there is a scale of cotangents exactly similar, except for the numbering, to the scale of tangents above. This scale of cotangents extends from 45° to 65° and another section of this same scale, but situated at the left hand end of the slide, extends from 42° to 45°. Directly beneath the main scale of cotangents there is an alternative scale of the northern boundaries of the townships of the third system of surveys. This alternative scale extends from township 0 to township 144.

Upon the face of the slide, at the left hand end, there is a scale of secants extending from 8° to 65°. Directly above this scale of secants there is an alternative scale of the northern boundaries of the townships of the third system of surveys, the townships extending from 0 to 144.

Upon the back of the slide there are four scales of sines.

The second scale is merely a scale of numbers, numbered 1′, 2′ and 3′. The third scale is also merely a scale of numbers from 4′ to 34′. Neither of these scales possess any graduations of its own, the graduations of the fourth, or bottom scale being utilized.

The fourth, or bottom, scale extends from 35′ to 5°44′; and the first, or top, extends from 5°44′ to 24°, both of these scales being graduated.

At the right hand end these sine scales have zeros which indicate where the significant figures come in the values of the natural sines of the angles embraced by these scales. The significant figures follow the zeros:

1st	scale	0.
2nd	"	0.000
3rd	"	0.00
4th	"	0.0

Upon the back of the rule there is an identification scale for finding the value of Z. It is a cosine scale of equal parts and is printed instead of engraved. It extends from 30° to 90°, and below it are given the rules for finding the azimuth from the north as measured through the east, south and west, after the value of Z has been determined; these rules being:

When A − B is +	and time is a.m.,	Azimuth	from	North	= Z.
When A − B is −	" " "	"	"	"	= 180° − Z.
When A − B is −	" " p.m.	"	"	"	= 180° + Z.
When A − B is +	" " "	"	"	"	= 360° − Z.

15¢ -

THE D.L.S. SLIDE RULE
FOR COMPUTING ALTITUDE-AZIMUTHS

FACE OF RULE AND FACE OF SLIDE

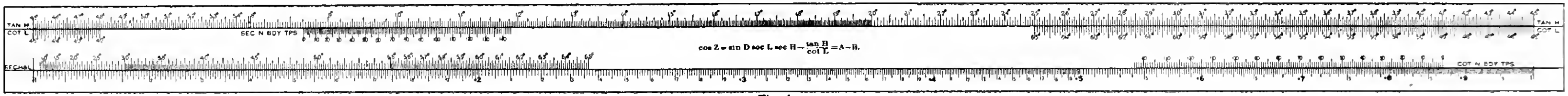


Fig. 1

FACE OF RULE AND BACK OF SLIDE

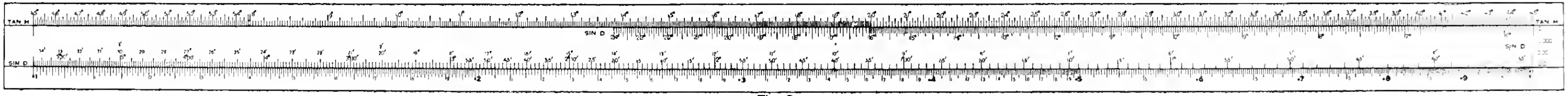


Fig. 2

BACK OF RULE
AND
IDENTIFICATION SCALE FOR Z

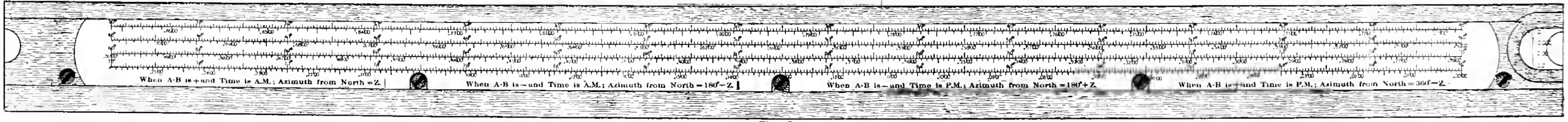


Fig. 3

The method of computation follows:—

To obtain A:

1. Set declination of sun, D, on SIN D scale to index at right, on back of rule; and indicator to latitude, L, of observation station on SEC h & L scale.

2. Set index of slide to this mark and move indicator to altitude of sun, h, on SEC h & L scale; reading off value of A on number scale at indicator.

To obtain B:

1. To the altitude of the sun, h, on TAN h scale set the latitude, L, of observation station on COT L scale, and read off value of B on number scale, below index of slide.

To obtain azimuth from the north:

1. Add together A and B and find the value of Z on back of rule; then by using rules given below identification scale, determine the value of the azimuth from the north.

Since the equation to be solved is given on the front of the slide, and the rules for finding the azimuth from the north are given on the back of the rule, the computer is spared the necessity of remembering them.

The following typical example will serve as a practical demonstration of the method of operation:

Assumed data:

Date—June 7th, 1915; 5.10 P.M. (time only approximate).
Place—N.E. Corner Tp. 23, R. 2, W. of 6th Meridan.
Corrected Altitude—25° 06′.
Interpolated Declination—N 22° 44′.
Angle between Sun and E. By. Sec. 36 - 275° 40′.
It is rquired to find the true bearing of the line.

To obtain A:

1. Set declination of sun, 22°44′, on SIN D scale to index at right, on back of rule; and indicator to latitude of observation station, Tp. 23, on SEC. N. BDY. TPS. scale.

2. Set index of slide to this mark and move indicator to altitude of sun, 25°06′, on SEC h & L scale; reading off A = +0.6782 on number scale at indicator, A being + because sun is north of the equator.

To obtain B:

1. To the altitude of the sun 25° 06′, on TAN h scale set the latitude of observation station, Tp. 23, on COT, N. BDY. TPS. scale, and read off B = +0.5768 on number scale, below index of slide.

Then A − B = + 0.6782 − 0.5786 = + 0.0996.

From identification scale Z = 84°17′, and since A − B is +, and time is P.M., the azimuth from the north is 360° — 84°17′, or 275°43′.

Therefore the bearing of the E. Bdy. of section 36 is 0°03′ (according to the assumed data).

The error in azimuth caused by an error of one-tenth millimetre in reading (A-B) on the rule may be investigated as follows:

Since the identification scale is made sufficiently large to preclude any error in determining Z from A-B, it follows that any error in Z must be due to an error in A-B; and errors in A-B can be due only to errors in reading these quantities on the rule. It has been assumed that A-B can be determined with an accuracy of one-tenth millimetre; *i.e.*, A and B can each be read with an accuracy of one-twentieth millimetre; and upon this assumption it is proposed to find the maximum resulting error in Z.

The total graduated length of the rule is 50 cm; or 10,000 units of 1-20 mm.

If N be any number on the number, or lower scale; its distance from the zero point in units of 1-20 mm. is given by:

$$\text{Distance} = \log_{10} 10N \times 10{,}000,$$

$$= \frac{\log_e 10N}{\log_e 10} \times 10{,}000,$$

$$\text{Therefore, d Distance} = \frac{dN}{N} \times \frac{10{,}000}{2.302}.$$

Putting d Distance = 1 unit; *i.e.*, 1-20 mm., there is obtained $dN = \frac{2.302N}{10{,}000}$.

Therefore d N is the error in N for an error of 1-20 mm. in reading N; or the accuracy of the rule is 2.302 parts in 10,000.

The operations performed on this rule are expressed by:

$$\cos Z = \sin D \sec h \sec L - \frac{\tan h}{\cot L} = \text{A-B}.$$

It is easily seen that both A and B increase as the angles increase, but as L increases the maximum value of h decreases due to the inadvisability of observing altitudes greater than those embraced by the arbitrary limiting factor $\frac{dZ}{dh} = 2$. Upon investigation it was found that A + B for different latitudes and for $\frac{dZ}{dh} = 2$, was nearly constant, increasing slightly, however, for the lower values of the latitude; and possessing a value of about 2.3000. It should be noted that the value of A + B rather than A − B has been taken because of the fact that the error in A − B is dependent upon A and B, or A + B.

Since the accuracy of the rule is 2.302 parts in 10,000, it follows that the error in A − B is equal to 2.302 multiplied by 2.300 and divided by 10,000, or about 0.0006; and the corresponding error in the azimuth is 2′.

The accuracy of this rule, therefore, even under the most unfavourable conditions, is equal to the accuracy of the transit; for the upper limit of altitude has been assumed to be such that an error of one minute in altitude produces an error of two minutes in azimuth; and therefore, when $\frac{dZ}{dh} = 2$, both the slide rule and the transit possess an accuracy of 2′.

As the conditions rapidly become more favorable for lower altitudes, the accuracy of the slide rule very rapidly increases, until when observations are made on or in the neighbourhood of the prime vertical, the maximum error due to reading the slide rule becomes quite negligible.

Such an instrument should prove of some considerable value in traverse and exploratory surveys, locating timber berths and mining claims, and general subdivision work whenever through daylight or clouds observations are not obtainable on Polaris.

DIAGRAMS FOR THE APPROXIMATE DETERMINATION OF LATITUDES AND DEPARTURES.

By W. H. Herbert, B.Sc.

A traverse survey is commenced at one of the traverse hubs planted by the surveyor while running the section or lot lines, and is closed upon the next traverse hub or upon a section, quarter section or lot corner. The traverse of a lake or island lying entirely within a section or lot must be properly connected with the rest of the survey.

In general, a traverse survey is connected with as many as possible of the section, quarter section or lot corner monuments that may be available. These ties serve to locate the traverse survey with previous surveys made in the same neighborhood, and also supply convenient checks for governing the traverse.

It is very often a matter of difficulty to locate these monuments owing to their deterioration or to the surrounding vegetation. However, when one has been located the others may be found by calculating approximately the latitudes and departures of the course.

These calculations need be made only roughly, and for this purpose Mr. P. E. Palmer, D.L.S., suggested an abacus of the form shown in fig. 1, which has been printed and inserted in the books for "Field Notes of Stadia Traverses."

Employing the usual system of Cartesian co-ordinates the elements of this abacus may be expressed as follows:

x = departure = chainage x sin bearing.

y = latitude = chainage x cos bearing.

$\sqrt{x^2 + y^2}$ = chainage, — indicated by the concentric circles.

$\frac{x}{y}$ = tan bearing, — indicated by the radials.

The abacus is confined to a semi-circle for the purpose of conserving space, the bearings from 180° to 360° being turned backward to coincide with the bearings from 180° to 0°. The method of use is obvious and requires no explanations; but as the figure is composed of four systems of superimposed lines it is liable to be confusing to the eye. This defect can be obviated by using the method of aligned, numbered points so ably developed by M. Maurice d'Ocagne.*

*"Traité de Nomographie," by Maurice d'Ocagne, Paris, 1899, Gauthier-Villars.

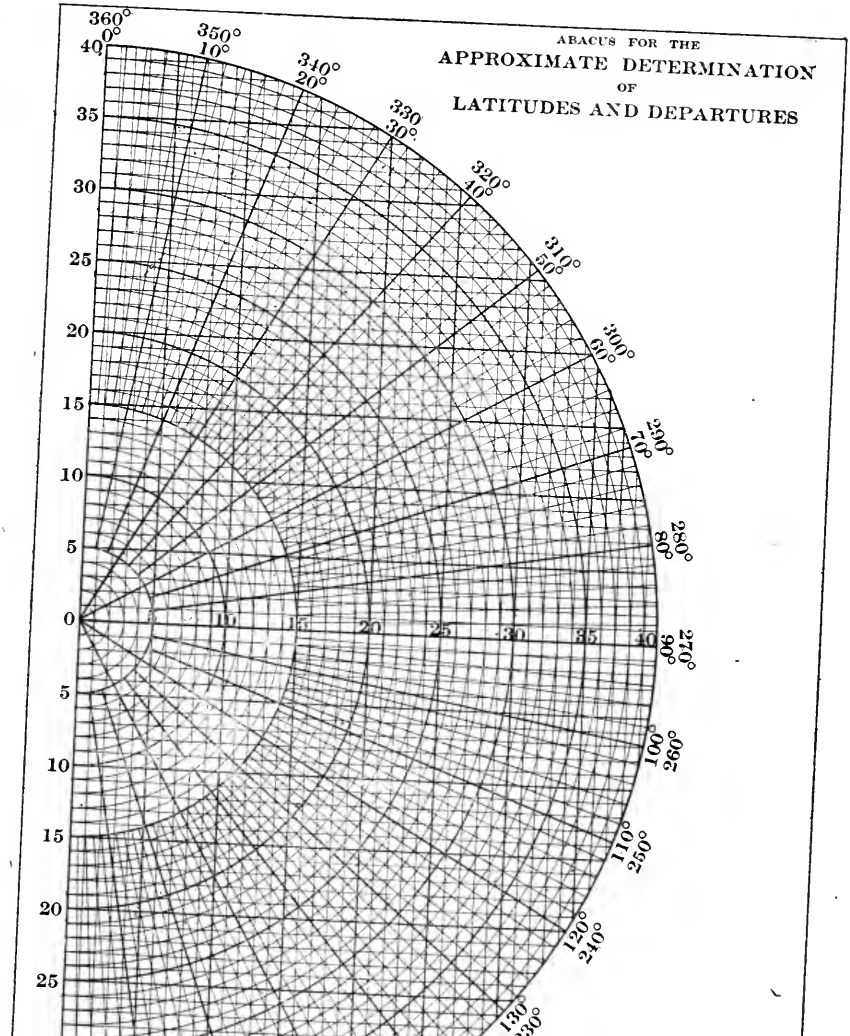

ABACUS FOR THE
APPROXIMATE DETERMINATION
OF
LATITUDES AND DEPARTURES
360° 0°
350° 10°
340° 20°
330° 30°
320° 40°
310° 50°
300° 60°
290° 70°
280° 80°
270° 90°
100° 260°
110° 250°
120° 240°
130° 230°
140° 220°
150° 210°
160° 200°
170° 190°
180° 180°
40
35
30
25
20
15
10
5
0
5
10
15
20
25
30
35
40
10
15
20
25
30
35
40

FIG. 1.

The equations to be solved are of the form $f_1 \times f_2 = f_3$, or $\log f_1 + \log f_2 = \log f_3$ where f_1, f_2 and f_3 are three functions. This latter type of equation is one for which Captain Lafay constructed, in 1895, a nomogram* in connection with his research work in elliptical polarization, based on d'Ocagne's methods.

The principles underlying the construction of this nomogram are illustrated in Fig. 2. The nomogram consists of three diverging straight lines, the centre line bisecting the angle contained between the other two.

It may be very easily proved by elementary trigonometry that if the three lines OA, OB, and OC be graduated with a common unit of length and the three points A, B and C lie on a straight transversal, or are aligned, as it is called, then they satisfy the equation $\frac{1}{OA} + \frac{1}{OB} = \frac{2 \cos W}{OC}$.

If the unit used in graduating OC be made equal to cos W times the unit used in graduating OA and OB, and W be made 30° then $\frac{1}{OA} + \frac{1}{OB} = \frac{2}{OC}$. If now $\log f_1$ be put equal to $\frac{1}{OA}$, etc., the equation $\log f_1 + \log f_2 = \log f_3$, or $f_1 \times f_2 = f_3$ may be solved by laying a straight edge across the scales.

Captain Lafay shows that in order to give finite dimensions to the scales when the functions vary between zero and infinity, it is necessary to add a constant to each term of the equation. The scales thus obtained would generally have most of the graduations concentrated towards one end.

This defect may be remedied by multiplying the equation by some constant. Also in order that the nomogram shall be symmetrical, the two outer scales forming the two sides and the middle scale the median of an isosceles triangle, suitable constants must be added to the terms. The final eqaution then takes the form:

$$\left\{ H_1 + k\left(\frac{1}{OA} - h_1\right) \right\} + \left\{ H_2 + k\left(\frac{1}{OB} - h_2\right) \right\} = (H_1 + H_2) + \left\{ \frac{2}{CO} - (h_1 + h_2) \right\} k.$$

The right hand scale is designed as follows:

The end of the scale is to carry the point sin 90° or cos 0° in which case $\log f_2 = 0$ when OB = 1.

*"Journal de Physique théroique et appliqué," 3 eme serie, t IV, April, 1915, p. 178.

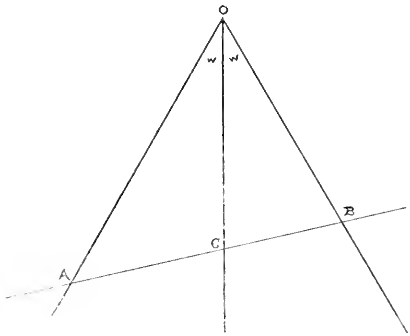


FIG. 2.

Putting $H_2 + k\ (1\text{-}h_2) = 0$, it is seen that $H_2 = 0$ and $h_2 = 1$ may be substituted as a solution. Furthermore, in order that the point 45° may be placed in the centre of the scale, — where OB = ½ — the expression becomes:

$k\ (2\text{-}1) = \log \sin 45° = -\ 0.15,$
or, $k = -\ 0.15.$

The expression for OB then becomes: $OB = \dfrac{0.15}{1.15 - \log f_2}.$

The left hand scale is designed as follows:

The end of the scale is to carry the point 40 chains in which case $\log f_1 = 1.602$ when $OA = 1$.

Putting $H_1 - 0.15\ (1\text{-}1) = 1.602$, it is seen that $H_1 = 1.602$.

The expression for OA then becomes: $OA = \dfrac{0.15}{1.752 - \log f_1}.$

Since all the constants have now been assigned, the middle scale has been definitely fixed, and the expression for OC becomes:

$$OC = \frac{0.30}{1.902 - \log f_3}.$$

This nomogram is shown in Fig. 3.

It is quite evident from the above exposition that only two scales need necessarily be calculated, as the third scale may always be obtained by means of a straight-edge.

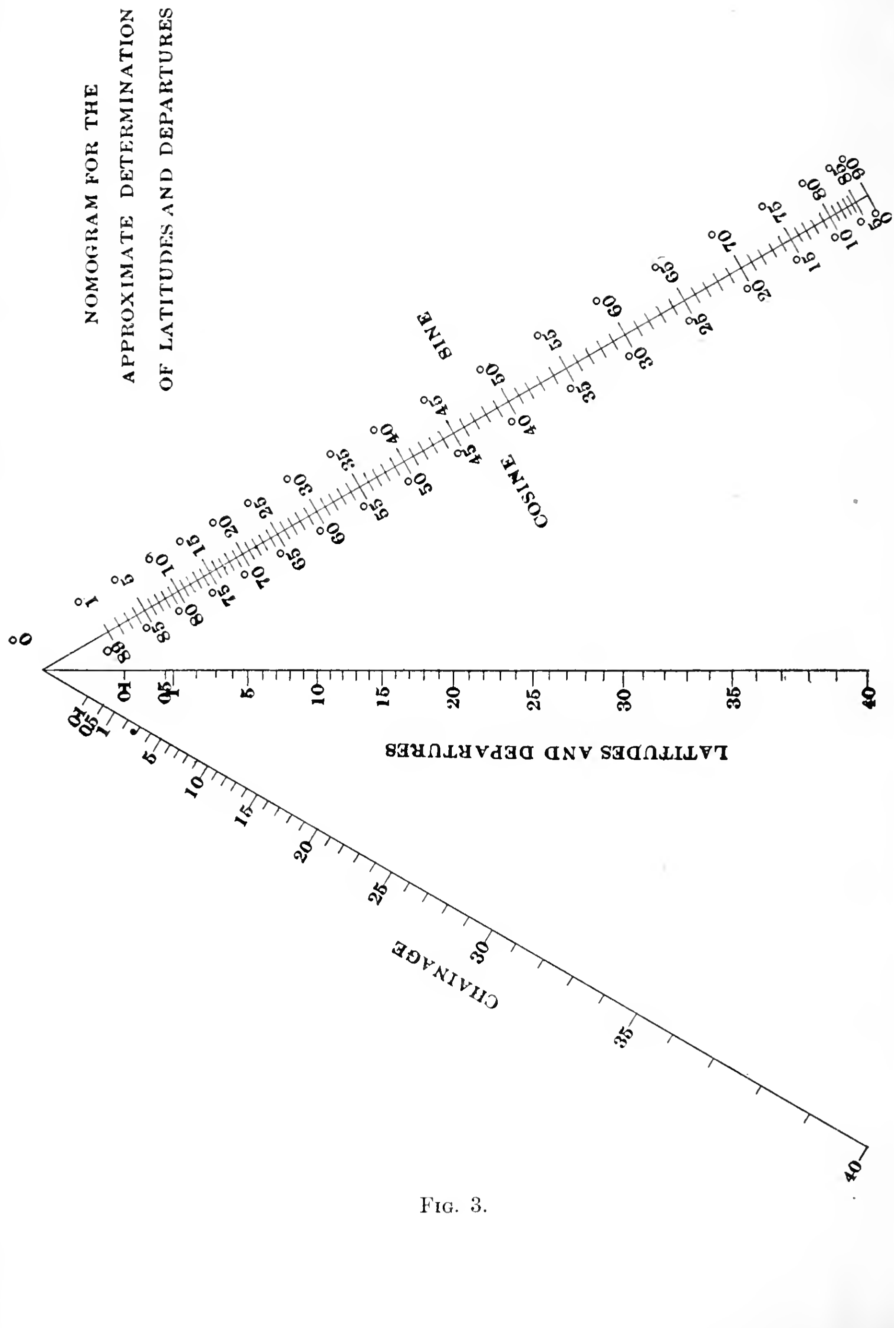

NOMOGRAM FOR THE
APPROXIMATE DETERMINATION
OF LATITUDES AND DEPARTURES
SINE
COSINE
LATITUDES AND DEPARTURES
CHAINAGE

FIG. 3.

The method of use has already been indicated. It consists of laying a straight-edge across the three scales so as to touch the chainage on the left scale and the sine or cosine of the bearing on the right scale, when the point of intersection on the centre scale will give the departure or latitude desired. It should be noted that there is no necessity for drawing lines on the nomogram, a straight-edge of whatever kind being the only appliance needed in making readings. Another point to be noted is that since the unknown quantity—the latitude or departure—is found on the middle scale, a solution is always given.

The ease of constructing this type of nomogram and the simplicity of using it should commend it for many purposes where the multiple system of superimposed curves of the ordinary abacus are considered confusing.

AN EPHEMERIS GIVING THE SOLAR DECLINATION FOR ALL YEARS.

By W. H. Herbert, B.Sc.

For solar altitude-azimuths it is considered sufficient to interpolate the declination to the nearest minute only, because the nature of the observations makes more accurate interpolations superfluous.

A method for using for all the years the ephemeris for any one year is derived as follows:

The solar year is composed of 365.24222 days, and is the interval of time contained between two successive passages of the mean sun across the mean vernal equinox.

In astronomical practice the beginning of a solar year is assumed to be the moment when the right ascension of the mean sun is 280°, or $18^h\ 40^m$.

A point not generally understood and utilized is that during successive solar years the solar declination and its differential, for practical purposes, always progress in the same way through the same range of values.

Consequently, if an ephemeris were constructed for one solar year it would serve for all solar years.

Ephemerides, however, are constructed for the Gregorian civil year, which necessitates the construction of an ephemeris for each year.

The relation between solar ephemerides for any two civil years may then be expressed by a corresponding relation between the solar and Gregorian dates; and a determination of this latter relation will enable the use of one ephemeris for an unlimited number of years.

This relation may be established as follows:

At the fundamental epoch 1900, January 0, Greenwich mean noon, the right ascension of the fictitious sun, referred to the mean equinox, and affected by aberration, was $18^h\ 38^m\ 45^s.836$.* Its motion in a Julian year is $24^h\ 0^m\ 1^s.84542$, with a minute acceleration of the precession of the equinoxes.

If t = right ascension of the mean sun at any time, and T = time after 1900, January 0, Greenwich mean noon, reckoned in Julian centuries of 36,525 days, then $t = 18^h\ 38^m\ 45^s.836 + 8{,}640{,}184^s.542T + 0^s.0929T^2$.

*Compendium of Spherical Astronomy"—Newcomb, p. 125, The MacMillan Company, 1906.

But $t = 280^\circ$ or $18^h\ 40^m$ at the beginning of a solar year, which falls as nearly as may be to the beginning of the Gregorian civil year. Therefore, it will be seen from the expression for t that the beginning of the solar year for 1900 occurred after the fundamental epoch January 0 by the interval necessary for the mean sun to move through the arc $18^h\ 40^m - 18^h\ 38^m\ 45^s .836 = 74^s .164$; which, expressed as a decimal of a day becomes 74.164 multiplied by 365.25 and divided by 86402, which is 0.31352 day.

Therefore, the solar year 1900 began at 1900 January 0.31352 Greenwich mean time. This is a moment of absolute time as it has no reference to any special meridian.

The solar year thus defined is sometimes called the *Besselian Fictitious Year*, after Bessel, who first introduced it into astronomy.

The beginning of preceding or subsequent solar years may be found by repeated addition or substraction of 365.24222 days.

From these considerations it may be seen that in order to make possible the use of only one ephemeris for many civil years, it is necessary to apply only some factor to the common ephemeris. This factor is hereafter called the "Year Factor." It is constant for the whole of any year, except leap years; but is different for different years.

The solar declination ephemeris selected as standard is that for 1915, and is herein reproduced.

Let Y be the year factor for any year,

Then $Y = 24^h .00000 - 5^h .81328$ (date of year — 1915).

The values of Y have been calculated for the years 1901 to 1933 and are given in a table following.

In leap years the conditions are somewhat different for then there is one day more in February. Therefore, for the months of January and February *only*, and only in leap years, the factors must be decreased by 24 hours.

These values of Y are also given in the table of year factors.

THE SUN'S APPARENT DECLINATION AND VARIATION FOR ONE HOUR AT GREENWICH MEAN NOON.

1915. 1915.

Day.	January.			February.			March.			April.			Day.
1	S23°	04′.5	0′.20	S17°	19′.5	0′.70	S7°	53′.2	0′.95	N 4°	13′.9	0′.96	1
2	22	59 .7	0 .22	17	02 .6	0 .72	7	30 .5	0 .95	4	37 .0	0 .96	2
3	22	54 .4	0 .24	16	45 .3	0 .73	7	07 .6	0 .96	5	00 .1	0 .96	3
4	22	48 .7	0 .26	16	27 .7	0 .75	6	44 .6	0 .96	5	23 .1	0 .96	4
5	22	42 .5	0 .28	16	09 .8	0 .75	6	21 .6	0 .97	5	46 .0	0 .95	5
6	22	35 .8	0 .30	15	51 .7	0 .77	5	58 .4	0 .97	6	08 .8	0 .95	6
7	22	28 .7	0 .31	15	33 .3	0 .78	5	35 .2	0 .97	6	31 .5	0 .94	7
8	22	21 .2	0 .33	15	14 .6	0 .79	5	11 .9	0 .97	6	54 .1	0 .94	8
9	22	13 .2	0 .35	14	55 .6	0 .80	4	48 .5	0 .98	7	16 .6	0 .93	9
10	22	04 .8	0 .37	14	36 .4	0 .81	4	25 .1	0 .98	7	39 .0	0 .93	10
11	21	56 .0	0 .39	14	17 .0	0 .82	4	01 .6	0 .98	8	01 .2	0 .92	11
12	21	46 .7	0 .40	13	57 .3	0 .83	3	38 .0	0 .98	8	23 .3	0 .91	12
13	21	37 .0	0 .42	13	37 .4	0 .84	3	14 .4	0 .98	8	45 .2	0 .91	13
14	21	26 .9	0 .44	13	17 .2	0 .85	2	50 .8	0 .99	9	07 .0	0 .90	14
15	21	16 .4	0 .46	12	56 .9	0 .86	2	27 .1	0 .99	9	28 .7	0 .90	15
16	21	05 .4	0 .47	12	36 .3	0 .86	2	03 .4	0 .99	9	50 .2	0 .89	16
17	20	54 .1	0 .49	12	15 .6	0 .87	1	39 .7	0 .99	10	11 .5	0 .88	17
18	20	42 .4	0 .51	11	54 .6	0 .88	1	16 .0	0 .99	10	32 .7	0 .87	18
19	20	30 .2	0 .52	11	33 .5	0 .89	0	52 .2	0 .99	10	53 .7	0 .87	19
20	20	17 .7	0 .54	11	12 .1	0 .90	0	28 .5	0 .99	11	14 .5	0 .86	20
21	20	04 .8	0 .55	10	50 .6	0 .90	S0	04 .8	0 .99	11	35 .1	0 .85	21
22	19	51 .5	0 .57	10	29 .0	0 .91	N0	18 .9	0 .99	11	55 .6	0 .84	22
23	19	37 .9	0 .58	10	07 .1	0 .91	0	42 .6	0 .98	12	15 .8	0 .83	23
24	19	23 .9	0 .60	9	45 .2	0 .92	1	06 .3	0 .98	12	35 .8	0 .83	24
25	19	09 .5	0 .61	9	23 .0	0 .93	1	29 .9	0 .98	12	55 .7	0 .82	25
26	18	54 .8	0 .63	9	00 .8	0 .93	1	53 .5	0 .98	13	15 .3	0 .81	26
27	18	39 .7	0 .64	8	38 .4	0 .94	2	17 .0	0 .98	13	34 .7	0 .80	27
28	18	24 .4	0 .66	8	15 .9	0 .95	2	40 .5	0 .98	13	53 .8	0 .79	28
29	18	08 .6	0 .67	S7	53 .2	0 .95	3	03 .9	0 .97	14	12 .8	0 .78	29
30	17	52 .6	0 .68	...	...	...	3	27 .3	0 .97	14	31 .5	0 .77	30
31	17	36 .2	0 .70	...	...	...	3	50 .6	0 .97	N14	49 .9	0 .76	31
32	S17	19 .5	0 .70	...	...	...	N4	13 .9	0 .96	...	...	...	32

THE SUN'S APPARENT DECLINATION AND VARIATION FOR ONE HOUR AT GREENWICH MEAN NOON.
1915. 1915.

DAY.	MAY.			JUNE.			JULY.			AUGUST.			DAY.
1	N14°	49′.9	0′.76	N21°	56′.9	0′.34	N23°	10′.5	0′.16	N18°	14′.4	0′.62	1
2	15	08 .2	0 .75	22	05 .1	0 .33	23	06 .6	0 .17	17	59 .4	0 .64	2
3	15	26 .1	0 .74	22	13 .0	0 .32	23	02 .4	0 .19	17	44 .1	0 .65	3
4	15	43 .9	0 .73	22	20 .6	0 .30	22	57 .7	0 .21	17	28 .5	0 .66	4
5	16	01 .3	0 .72	22	27 .7	0 .28	22	52 .6	0 .23	17	12 .6	0 .67	5
6	16	18 .5	0 .71	22	34 .4	0 .26	22	47 .1	0 .25	16	56 .5	0 .68	6
7	16	35 .5	0 .69	22	40 .7	0 .25	22	41 .2	0 .26	16	40 .1	0 .70	7
8	16	52 .1	0 .68	22	46 .7	0 .23	22	34 .9	0 .28	16	23 .4	0 .71	8
9	17	08 .5	0 .67	22	52 .2	0 .22	22	28 .2	0 .29	16	06 .4	0 .72	9
10	17	24 .6	0 .66	22	57 .4	0 .20	22	21 .2	0 .31	15	49 .2	0 .73	10
11	17	40 .4	0 .65	23	02 .1	0 .18	22	13 .7	0 .32	15	31 .7	0 .74	11
12	17	55 .9	0 .63	23	06 .4	0 .16	22	05 .9	0 .34	15	14 .0	0 .75	12
13	18	11 .1	0 .62	23	10 .3	0 .15	21	57 .7	0 .36	14	56 .0	0 .76	13
14	18	26 .0	0 .61	23	13 .9	0 .13	21	49 .1	0 .37	14	37 .8	0 .77	14
15	18	40 .6	0 .60	23	17 .0	0 .11	21	40 .1	0 .39	14	19 .3	0 .78	15
16	18	54 .9	0 .58	23	19 .6	0 .10	21	30 .8	0 .40	14	00 .7	0 .79	16
17	19	08 .8	0 .57	23	21 .9	0 .08	21	21 .1	0 .42	13	41 .8	0 .80	17
18	19	22 .5	0 .55	23	23 .8	0 .06	21	11 .0	0 .43	13	22 .7	0 .80	18
19	19	35 .8	0 .54	23	25 .2	0 .05	21	00 .6	0 .45	13	03 .4	0 .82	19
20	19	48 .7	0 .53	23	26 .3	0 .03	20	49 .8	0 .46	12	43 .8	0 .82	20
21	20	01 .4	0 .51	23	26 .9	0 .01	20	38 .7	0 .48	12	24 .1	0 .83	21
22	20	13 .6	0 .50	23	27 .1	0 .01	20	27 .2	0 .49	12	04 .2	0 .84	22
23	20	25 .6	0 .48	23	26 .9	0 .03	20	15 .4	0 .50	11	44 .1	0 .85	23
24	20	37 .2	0 .47	23	26 .3	0 .04	20	03 .3	0 .52	11	23 .8	0 .85	24
25	20	48 .4	0 .45	23	25 .3	0 .06	19	50 .8	0 .53	11	03 .3	0 .86	25
26	20	59 .3	0 .44	23	23 .9	0 .08	19	38 .0	0 .55	10	42 .7	0 .87	26
27	21	09 .8	0 .42	23	22 .0	0 .09	19	24 .8	0 .56	10	21 .9	0 .87	27
28	21	20 .0	0 .40	23	19 .8	0 .11	19	11 .4	0 .57	10	00 .9	0 .88	28
29	21	29 .7	0 .40	23	17 .1	0 .13	18	57 .6	0 .59	9	39 .8	0 .89	29
30	21	39 .2	0 .38	23	14 .0	0 .15	18	43 .5	0 .60	9	18 .5	0 .90	30
31	21	48 .2	0 .36	N23	10 .5	0 .16	18	29 .1	0 .61	8	57 .0	0 .90	31
32	N21	56 .9	0 .34	....	....	....	N18	14 .4	0 .62	N 8	35 .4	0 .90	3

THE SUN'S APPARENT DECLINATION AND VARIATION FOR ONE HOUR AT GREENWICH MEAN NOON.

1915. 1915.

Day.	September.			October.			November.			December.			Day.
1	N 8°	35′.4	0′.90	S 2°	52′.0	0′.97	S14°	10′.6	0′.80	S21°	41′.3	0′.40	1
2	8	13 .7	0 .91	3	15 .3	0 .97	14	29.9	0 .80	21	50 .8	0 .37	2
3	7	51 .8	0 .92	3	38 .6	0 .97	14	49 .0	0 .79	21	59 .8	0 .36	3
4	7	29 .8	0 .92	4	01 .9	0 .97	15	07 .9	0 .78	22	08 .4	0 .34	4
5	7	07 .7	0 .93	4	25 .1	0 .96	15	26 .5	0 .76	22	16 .6	0 .32	5
6	6	45 .4	0 .93	4	48 .2	0 .96	15	44 .8	0 .75	22	24 .4	0 .30	6
7	6	23 .1	0 .94	5	11 .3	0 .96	16	02 .9	0 .74	22	31 .7	0 .29	7
8	6	00 .6	0 .94	5	34 .3	0 .96	16	20 .7	0 .73	22	38 .6	0 .27	8
9	5	38 .1	0 .95	5	57 .3	0 .95	16	38 .3	0 .72	22	45 .0	0 .25	9
10	5	15 .4	0 .95	6	20 .1	0 .95	16	55 .5	0 .71	22	51 .0	0 .23	10
11	4	52 .7	0 .95	6	42 .9	0 .95	17	12 .5	0 .69	22	56 .6	0 .21	11
12	4	29 .9	0 .95	7	05 .6	0 .94	17	29 .1	0 .68	23	01 .6	0 .20	12
13	4	07 .0	0 .96	7	28 .2	0 .94	17	45 .5	0 .67	23	06 .3	0 .17	13
14	3	44 .0	0 .96	7	50 .7	0 .93	18	01 .6	0 .65	23	10 .4	0 .15	14
15	3	21 .0	0 .96	8	13 .1	0 .93	18	17 .3	0 .64	23	14 .1	0 .14	15
16	2	57 .9	0 .97	8	35 .4	0 .92	18	32 .7	0 .63	23	17 .4	0 .12	16
17	2	34 .7	0 .97	8	57 .5	0 .92	18	47 .8	0 .62	23	20 .2	0 .10	17
18	2	11 .5	0 .97	9	19 .5	0 .91	19	02 .6	0 .60	23	22 .5	0 .08	18
19	1	48 .3	0 .97	9	41 .4	0 .90	19	17 .0	0 .59	23	24 .3	0 .06	19
20	1	25 .0	0 .97	10	03 .1	0 .90	19	31 .1	0 .57	23	25 .7	0 .04	20
21	1	01 .7	0 .97	10	24 .7	0 .89	19	44 .8	0 .55	23	26 .6	0 .02	21
22	0	38 .4	0 .97	10	46 .1	0 .89	19	58 .1	0 .54	23	27 .1	0 .00	22
23	N 0	15 .0	0 .97	11	07 .4	0 .88	20	11 .1	0 .53	23	27 .0	0 .02	23
24	S 0	08 .4	0 .97	11	28 .5	0 .87	20	23 .8	0 .51	23	26 .5	0 .04	24
25	0	31 .8	0 .97	11	49 .5	0 .86	20	36 .0	0 .50	23	25 .5	0 .06	25
26	0	55 .2	0 .97	12	10 .2	0 .86	20	47 .9	0 .48	23	24 .1	0 .08	26
27	1	18 .5	0 .97	12	30 .8	0 .85	20	59 .4	0 .46	23	22 .2	0 .10	27
28	1	41 .9	0 .97	12	51 .2	0 .84	21	10 .4	0 .45	23	19 .8	0 .12	28
29	2	05 .3	0 .97	13	11 .3	0 .83	21	21 .1	0 .43	23	16 .9	0 .14	29
30	2	28 .7	0 .97	13	31 .3	0 .82	21	31 .4	0 .41	23	13 .6	0 .16	30
31	S 2	52 .0	0 .97	13	51 .1	0 .81	S21	41 .3	0 .40	23	09 .8	0 .17	31
32	....	....	....	S14	10 .6	0 .80	....	....	....	S23	05 .6	0 .19	32

YEAR FACTORS.

Year.	Year Factor.	Jan. and Feb.	Year.	Year Factor.	Jan. and Feb.
1901	+ 9h.4		1917	+ 12h.4	
1902	3 .6		1918	6 .6	
1903	21 .8		1919	0 .7	
1904	15 .9	– 8h.1	1920	18 .9	– 5h.1
1905	10 .1		1921	13 .1	
1906	4 .3		1922	7 .3	
1907	22 .5		1923	1 .5	
1908	16 .7	– 7h.3	1924	19 .7	– 4h.3
1909	10 .9		1925	13 .9	
1910	5 .1		1926	8 .1	
1911	23 .3		1927	2 .2	
1912	17 .4	– 6h.6	1928	20 .4	– 3h.6
1913	11 .6		1929	14 .6	
1914	5 .8		1930	8 .8	
1915	0 .0		1931	3 .0	
1916	18 .2	– 5h.8	1932	21 .2	– 2h.8
			1933	15 .4	

The method to be employed, then, of calculating the declination of the sun at any hour of any day in any year and at any meridian, is as follows:

Add the year factor to the hour angle factor and the factor for longitude from Greenwich, and then interpolate directly from the ephemeris.

The method is further exemplified in the following practical examples:

Example 1. Required the declination of the sun at 8 a.m. of December 5th., 1917, tp.100-10-5.

Year factor (from table)	+	12h4
Time factor (from watch)	–	4.0
Longitude factor (from Fig. 1)	+	7.7
Interpolation factor	+	16.1

From 1915 ephemeris, declination at Greenwich mean noon on December 5th, is S 22° 16′ .6 and is increasing southward by 0′ .32 per hour.

Therefore, declination required is:

S 22° 16′ .6 + 16.1 x 0′ .32 = S 22° 21′.8.

If this declination had been derived from a 1917 ephemeris the procedure would have been:

Time factor (from watch)	− 4h.0
Longitude factor (from fig. 1.)	+ 7.7
Interpolation factor	+ 3.7

From 1917 ephemeris, declination at Greenwich mean noon on December 5th. is S22° 20′.6 and is increasing southward by 0′.31 per hour.

Therefore, declination required is:

S 22° 20′ .6 + 3.7 x 0′ .31 = S 22° 21′.7.

Example 2. Required the declination of the sun at 6 p.m. of August 20th. 1906, tp. 30-20-2.

Year factor (from table)	+ 4h .3
Time factor (from watch)	+ 6 .0
Longitude factor (from fig. 1.)	+ 7 .0
Interpolation factor	+ 17 .3

From 1915 ephemeris, declination at Greenwich mean noon on August 20th, is N 12° 43′.8 and is increasing southward by 0′.82 per hour.

Therefore, declination required is:

N 12° 43′.8 − 17.3 x O′.82 = N 12° 29′.6.

If this declination had been derived from a 1906 ephemeris, the procedure would have been:

Time factor (from watch)	+ 6h.0
Longitude factor (from fig. 1.)	+ 7 .0
Interpolation factor	+ 13.0

From 1906 ephemeris, declination at Greenwich mean noon on August 20th, is N 12° 40′.5 and is increasing southward by 0′.82 per hour.

Therefore, declination required is:

N 12° 40′.5 − 13.0 x 0′.82 = N 12° 29′.8.

Example 3. Required the declination of the sun at 12 noon of January 17th, 1916, tp. 72-19-3.

Year factor (from table)	$- 5^h.8$
Time factor (from watch)	0.0
Longitude factor (from fig. 1.)	+ 7.3
Interpolation factor	+ 1.5

From 1915 ephemeris, declination at Greenwich mean noon on January 17th, is S. 20° 54′.1, and is increasing northward by 0′.49 per hour.

Therefore declination required is:

S 20° 54′.1 −1.5 x 0′.49 = S 20° 53′.4.

If this declination had been derived from a 1916 ephemeris, the procedure would have been:

Time factor from watch	$0^h.0$
Longitude factor (from fig. 1.)	+ 7.3
Interpolation factor	+ 7.3

From 1916 ephemeris, declination at Greenwich mean noon on January 17th, is S 20° 56′.8 and is increasing northward by 0′.48 per hour.

Therefore, declination required is:

S 20° 56′.8 − 7.3 x 0′.48 = S 20° 53′.3.

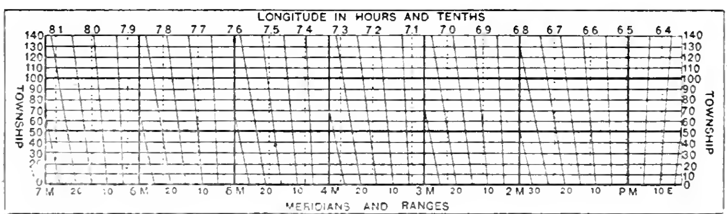


FIG. 1.

From these examples it is seen that the maximum difference between the declination computed by the perpetual ephemeris and the declination computed by the yearly ephemeris amounts to only 0′.2. This, of course, would be greatly reduced by using more figures in the computations.

Therefore, for calculating the sun's declination to the nearest minute, this one ephemeris for 1915 may be used for all conditions instead of using and referring to a separate ephemeris for each year, and no extra work is involved in doing so.

That this possibility is not appreciated and understood as widely as might be the case, reference may be made to "Norie's Navigation" as a particular example,* where an effort has been made to do away with the necessity for consulting a different ephemeris for each year when only approximate results are required.

Table X in this publication gives four ephemerides covering the sun's declination for 1908-12-16-etc.; for 1909-13-17 etc.; for 1910-14-18 etc.; and for 1911-15-19 etc.

Because the declination does not accurately repeat itself every four years, another table, XII, is used, which gives the corrections to be applied to table X to correct the sun's declinations for the changes in periods of four years for periods of 4-8-12-16-20 years and for 1-7-13-19-25 days of each month.

Thus, in place of one ephemeris and a list of year factors, Norie's Navigation uses four ephemerides and tables of corrections for years and days to serve the same purpose.

The great simplicity and brevity obtained by using these year factors should make this method of interpolating for solar declinations available to all.

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*"Norie's Navigation", by J. W. Norie, p. 118, published by Imray, Laurie, Norie and Wilson, Ltd., London, 1900.

THE D.L.S. SLIDE RULE FOR COMPUTING SLOPE CORRECTIONS AND ELEVATIONS.

By W. H. Herbert, B.Sc.

Lines may be chained by either of the two following methods:

1st. The two ends of the chain or such portion of the chain as is used are held at the same level and care is taken in plumbing and dropping the pins in order to obtain the accurate horizontal distance.

2nd. The two ends of the chain or such portion of the chain as is used are held at any convenient level, the angle of slope between the two points of support being measured by means of a clinometer. The horizontal distance is then obtained by calculation.

Nearly all ordinary measurements in the field are made by this latter method.

Instead of measuring distances between given points, a surveyor on original work is required to lay off lines of given horizontal lengths. In a practical case, therefore, having laid off on various slopes distances whose sum is equal to the distance required, he will wish to know how much farther it will be necessary to produce the line so that it may possess the correct horizontal length.

To calculate the balance of the length required, *i.e.*, the amount by which the measured length falls short of the horizontal length, it is obviously only necessary to multiply the length of each measured section by the cosine of its angles of inclination to reduce it to the horizontal, add together these horizontal lengths and subtract from the horizontal length required.

A quicker and better method is to multiply the length of each measured section by the versine* of its angle of inclination.

The sum of these products gives the additional length the line must be produced to compensate for the distance lost through measuring the line on slopes.

Since the lengths and the slopes of the several sections of a line are known it is an easy matter to calculate the vertical distance between the two ends of the line. In general, lines are measured in chains and links, and differences in elevation are calculated in feet.

It was proposed, then, to devise some means to enable a surveyor in the field to readily and accurately calculate both slope corrections in links and differences in elevation in feet.

*The versine of an angle is equal to 1 minus the cosine of that angle.

The accuracy desired was that slope corrections of all lines up to five chains in length should be determined with an error never exceeding one-tenth of a link.

The availability of slide rules for this purpose was investigated and it was found that the ten-inch rule might be adapted to perform these operations by designing certain special logarithmic scales.

This special slide rule for computing slope corrections and elevations is shown in the accompanying plate, where fig. 1 shows the face of rule and face of slide, and fig. 2 shows the face of rule and back of slide.

On the front of the rule there has been added one scale càlled F which is a duplication of the A scale except that it is displaced to the right by an amount sufficient to bring the point 66 on the F scale directly above the point 100 on the A scale. On the front of the slide the usual scales of tangents and logarithims have been dropped as being of very little practical use. In their place there has been added a single scale V of versines. Consequently this new rule possess only the usual number of scales found on the standard rule, though the arrangement has been somewhat modified.

It will be noted that all the scales in fig. 1 except D are essentially double scales; that is, the significant figures repeat themselves in the two sections, although the position of the decimal point changes. Thus the S, or sine, scale is divided at the middle into two sections S_1 and S_2; and the significant figures in the value of the natural sine of any angle on the S scale are found directly above on the A scale, a decimal point and zero being prefixed to the values of those angles on S_1, and simply a decimal point to those on S_2.

Similarly, the V, or versine, scale is divided at the middle into two sections V_1 and V_2, and the significant figures in the value of the natural versine of any angle on the V scale are found directly above on the A scale, a decimal point and two zeros being prefixed to the values of those angles on V_1, and a decimal point and one zero to those on V_2.

In general this rule will give the slope correction in links and the difference in elevation in feet with one setting of the slide.

The method of operation is as follows:

1. Set the index to the chainage in chains on scale A, and the cursor to the angle of slope on scale V, and read off the slope correction in links at the cursor on Scale A.

THE D.L.S. SLIDE RULE

FOR COMPUTING SLOPE CORRECTIONS AND ELEVATIONS

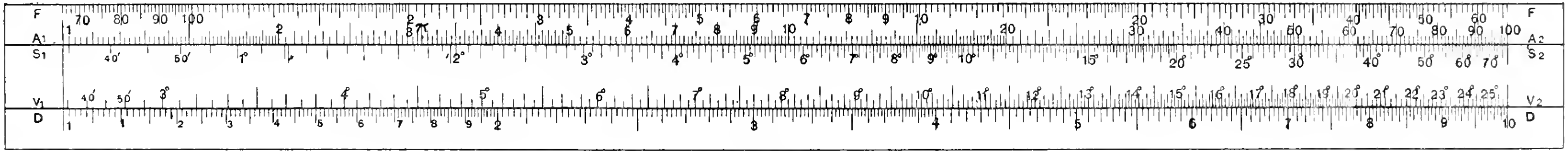


Fig. 1

FACE OF RULE AND FACE OF SLIDE.

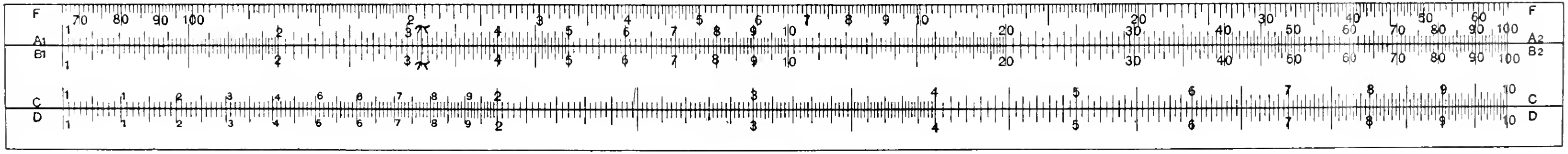


Fig. 2

FACE OF RULE AND BACK OF SLIDE.

2. Without moving the slide, next set the cursor to the angle of slope on Scale S, and read off the difference in elevation in feet at the cursor on scale F.

The method of operation is so simple as to require no further explanation.

It will be noted that directly above any length in links on scale A, there is found on scale F the equivalent length in feet, and *vice versa*.

The accuracy of the rule may be investigated as follows:

It is assumed that a reading may be made with an accuracy of 1-10 mm.

The graduated length of the scale; *i.e.*, half the rule, is 12.5 cm. or 1250 units of 1-10 mm.

If N be any value on a scale, its distance from the zero point in units of 1-10 mm. is given by:

$$\text{Distance} = \text{Log}_{10} \text{ N X } 1250,$$

$$= \frac{\log_e \ N}{\log_e \ 10} \text{ X } 1250.$$

By differentiating, this becomes:

$$\text{d distance} = \frac{dN}{N} \text{ X } \frac{1250}{2.302}$$

Putting d distance = I unit; *i.e.*, 1-10 mm., there is obtained

$$dN = \frac{2.302 \ N}{1250}$$

Therefore, dN is the error in N for an error of 1-10 mm. in reading N. The accuracy of the rule is then expressed by the ratio $\frac{2.302}{1250}$, or about 1-500 or 1-5 of one per cent.

Consequently, if the results be read off to within 1-10 mm, then the slope corrections and differences in elevation will be correct to one part in five hundred.

The result required, however, was that the slope corrections should be correct to 1-10 link. Now the largest angle on the versine scale is 25° 51′, and the maximum chainage is assumed to be 5 chains. Under these conditions the slope correction is 50 links; and since the result is given correct to one part in five hundred, it follows that this slope correction of 50 links is given correct to 50-500 link, or 1-10 link.

For smaller angles or shorter distances the slope correction is less and it is therefore given with an accuracy greater than 1-10 link.

It will be noted that the sine scale S extends only as low as 35 minutes. For any angle smaller than this, however, the elevation may be obtained by direct proportion, preferably in the ratio of 10 to 1. Thus for an angle of 30 minutes or 0.5 degree, which is not given on the scale, use the given angle 5 degrees instead.

Similarly, it will be noted that the versine scale V extends only as low as 2° 35′. For any angle smaller than this, however, the slope correction may likewise be obtained by direct proportion, without introducing any appreciable error, preferably in the ratio of 10 to 1.

Thus for an angle of 2° 30′ or 2° .5, which is not given on the scale, use the given angle 25° instead. This is the case where the discrepancy introduced by considering the versine of 2°.5 as equal to 1-100 of the versine of 25° is the greatest.

Assuming five chains as the maximum length to be encountered at one measurement, the true slope correction is found to be 0.475 link; whereas the rule gives the slope correction as 0.468 link; the difference being 0.007 link, or about 0.06 inch, which is quite negligible. As mentioned before, this may be taken as the maximum discrepancy.

From the preceding consideration it may be easily seen that without materially altering the ordinary standard ten-inch slide rule or in any way circumscribing its usefulness, certain special scales have been designed and added to the rule whereby the difference in elevation in feet and the slope corrections in links, correct to 1-10 link, may be obtained for any line at one setting of the slide.

The various other scales on the rule are in such general use and are so well described and explained in books of instructions as to need no further discussion.

This slide rule has been used by surveyors in the field and found quite satisfactory in every way under practical conditions.

It is sometimes pointed out that surveyors encounter slopes greater than 25° 51′, especially in the British Columbia Railway Belt, and that this rule affords no solution for such cases. It would be easy to add additional scales embracing all slopes up to 60°, say, especially if the Duplex form of slide rule were adopted. On the other hand, however, every additional scale tends to complicate a rule, and in the ordinary course of events not many slopes will be encountered greater than 25° 51′. For this reason it has been thought preferable to keep the rule in its present very simple form; ordinary calculations being used for slopes greater than 25° 51′.

OBITUARIES

Dr. W. F. King, D.T.S.

The late Dr. King, Honorary President of the Association of Dominion Land Surveyors, will be remembered as long as Dominion Land Surveys exist.

He was born at Stowmarket, Suffolk, England, on Feb. 19th, 1854, and died on Easter Sunday, April 23rd, 1916.

With his parents he came to Canada in 1862, the family settling at Port Hope. He matriculated at the University of Toronto in 1869, and obtained his B.A. in 1875, carrying off the gold medal for mathematics. His university course was broken by several years service on the astronomical staff of the International Boundary Survey along the 49th parallel east of the Rocky Mountains. In 1876 he obtained his commission as Dominion Land Surveyor, and also as Dominion Topographical Surveyor, being the first to receive the latter title. In this brief sketch of the activities and services of Dr. King, we are particularly concerned with his services in connection with Dominion Lands Surveys.

In 1876, 1877, 1878 he was in charge of one of the parties of the "Special Survey" in the Northwest. Many accurate determinations of latitude were made by him throughout the Northwest with the sextant, in advance of the surveys.

In 1879 he prepared the first geodetic tables for the Manual of Survey, which were later extended, and which form part of the Manual at the present day. It is essentially these tables, involving the consideration of the earth as a spheroid, that we had in mind when we said that his name will ever be remembered with the surveys. He entered the Inside Civil Service on June 13th, 1881, as Inspector of Surveys, and continued therein until his death. In 1886 he became Chief Inspector of Surveys, in 1890 Chief Astronomer, in 1905 Director of the Dominion Observatory, and in 1909, Superintendent of the newly founded Geodetic Survey.

In 1893 began the survey or resurvey of the whole boundary of Canada, beginning with that of Alaska, under an International Commission or Commissions, and from that date until the time of his death, Dr. King was always the British Commissioner.

His mathematical skill was universally acknowledged, and his genial yet retiring disposition endeared him to all who knew him, especially to those of a generation ago, who sat with him about the camp fire when the world was young and buffalo still grazed on the plain by the setting sun.

His alma mater honored him in 1904 with an LL.D., and four years later he was created a Companion of the Order of St. Michael and St. George.

We bow to his services in grateful memory.

Lt. H. Spencer Holcroft, D.L.S.

Lt. H. Spencer Holcroft was the youngest son of the late Thos. Holcroft, of Orillia, in which place he was born Sept. 4th, 1870.

He was educated at Upper Canada College and Trinity College School, Port Hope, was a graduate of the School of Practical Science in mining and Civil Engineering.

He obtained his commission as a Dominion Land Surveyor in 1903, and did a great deal of surveying in the West, particularly in the Peace River District.

When War broke out, he was engaged in work at Fort Churchill, and after his return to Toronto, went to Calgary to join the 2nd Tunnelling Co., with which he was serving in France at the time of his death. He had for many years been a Lieutenant in the G. G. B. G., and was a member of the Toronto Hunt.

Lieut. Benjamin Clifford Pierce, D.L.S.

Among those who have fallen at the battles of Vimy Ridge, which commenced Easter Monday, is Lieut. B. C Pierce, son of Rev. and Mrs. Barry Pierce, Kingston. He enlisted in the 59th Kingston Battalion under Lieut.-Col. H. J. Dawson, when that Battalion was in Brockville. In England the battalion was broken up and Lieut. Pierce was transferred to the 4th Canadian Mounted Rifles, and was with that unit since then. His parents received a message which informed them that their heroic son had fallen on either April 9th or 10th, 1917.

The deceased Lieutenant was born at the Parsonage, Cape Ozo, Gaspe, Quebec, on November 5th, 1890. He attended Perth and Kingston Collegiates and Queen's University, receiving from the University the degree of Bachelor of Science in 1912. The second year following brought him his commision as both Ontario and Dominion Land Surveyor.

After spending the intervening years surveying in Western Canada, he came home in November, 1915, and after qualifying at the Infantry School here, he was granted his commission as Lieutenant in the 59th Battalion and was recognized as a most efficient officer. He was a worthy member of Princess Street Methodist Church, and also a member of the Minden Masonic Lodge of this city.

Mr. J. W. Pierce, of Pembroke, the well known surveyor, is a brother of the late Lieut. B. C. Pierce; another brother, Lieut. Gordon B. Pierce, is at the front, and two sisters, besides his parents, the Rev. Barry and Mrs. Pierce, survive him.

Lieut. Laurence H. Gass, D.L.S.

It is with deep regret that we record the death of Lieut. Laurence H. Gass, son of Mr. J. B. Gass, Iroquois, Ontario.

The late Lieut Gass, was born at Amherst, Nova Scotia, October 21st, 1890. "Laurie" as he was known at school and college, was educated at the Montreal High School, entering the latter at seventeen years of age, graduating B.Sc., at the age of twenty-one. He took up Mining Engineering for a time, then went in for land surveying, obtaining his commission as Dominion Land Surveyor in 1913 He heard his country's call for overseas service and went to Quebec in the winter of 1915-16, taking a Lieutenant's course in Heavy Artillery. In May, 1916, he went overseas with a draft to reinforce the Montreal Heavy Artillery Brigade, but on arrival joined the 5th Battery, Canadian Siege Artillery; was sent to France in September and was on the Somme front until December, when he went north in the vicinity of Arras. He was killed in action, Sunday, April 8th, 1917, while bravely doing his duty.

Lieut. Lambert Ernest Stanley Bolton, D.L.S.

Lieut. Lambert Ernest Stanley Bolton, son of the Rev. Charles and Martha Bolton, was born at Wiarton, Ontario, June 10th, 1888. He was educated at the Collegiate Institute, St. Catharines, and at the Waterford High School, and later attended McGill University. In 1909, he went with Mr. A. H. Hawkins, D.L.S., on survey work in the Peace River country. He passed his preliminary examination for Dominion Land Surveyor in 1911, and final in 1914. For several years he was engaged with different surveyors, on Dominion Land Surveys in Saskatchewan and Peace River District. In 1915 he enlisted as a private in the

First Pioneer Battalion, and proceeded to England immediately. After passing safely through the fight near Ypres, June 2nd and 3rd, he was unfortunately killed during the re-taking of those trenches on June 13th, 1916, by the explosion of a shell.

E. W. P. Robinson, D.L.S.

It is the sad duty of this Association to chronicle the untimely death of the late E. W. P. Robinson, who was accidentally drowned in Sturgeon Lake, Manitoba, August 14th, 1916.

Details of the sad event are very meager, but from what can be ascertained, Mr. Robinson had just completed some work at Sturgeon Lake, and was preparing to paddle about 12 miles to where a trail connects Sturgeon Lake with Beaver Lake, when the accident occurred. Captain Ross, a northern navigator, instituted a search for Mr. Robinson and found his canoe with sail attached to a broken mast; the paddle and a box were also found on the shore of the lake, but to date the body has not been recovered.

Mr. Robinson was born and educated in London, England, and only thirty-eight years of age. He came to Canada about sixteen years ago, and for a number of years was engaged on railroad work for the C. N. R. and C. P. R. in Northern Alberta and Peace River District. He received his commission as Dominion Land Surveyor in 1910, and was subsequently employed by the Department of the Interior on survey work in the railway belt in British Columbia, and in the running of base lines in Saskatchewan and Manitoba.

The last two years of his life were devoted to his mining interests at Beaver Lake and vicinity. He was a Justice of Peace for the Provinces of Manitoba and Saskatchewan, and his gentlemanly demeanor ingratiated him into the hearts of his many friends.

He is survived by his wife and infant daughter, also his parents and three sisters, in London, England, and a brother now serving with the Army in Egypt.

LIST OF MEMBERS

HONORARY MEMBERS.

HON. PATRON:

DEVILLE, E., LL.D., I.S.O., D.T.S., Surveyor-General, Interior Dept., Ottawa.

HON. PRESIDENT:

KLOTZ, OTTO, D.Sc., D.T.S., Assistant Chief Astronomer, Interior Dept., Ottawa

HON. MEMBERS:

CASGRAIN, Hon. J. P. B., D.L.S., Senator, The Senate, Ottawa.
MAGRATH, C. A., D.T.S., Commissioner, International Joint Commission, Ottawa
DENNIS, J. S., D.T.S., Assistant to the President of C.P.R., Montreal.
MCFADDEN, M., D.L.S., Brandon, Man.
STEWART, W. J., Chief Hydrographer, Marine Dept., Ottawa.
CAMPBELL, R. H., Director of Forestry, Interior Dept., Ottawa
SYMES, P. B., Ottawa.

PAST PRESIDENTS.

HUBBELL, E. W., 1907-08.
YOUNG, R. E., 1909-1910.
FAWCETT, THOS., 1911.
BELANGER, P. R. A., 1912
MILES, C. F., 1913.
AYLSWORTH, C. F., 1914.
HAWKINS, A.H., 1915-1916.

Date of Election.

LIST OF ACTIVE MEMBERS.

1912—Akins, J. R., R.R. 4 Queenston St., St. Catharines, Ont.
1907—Aylsworth, C. F., Madoc, Ont.

1913—Baird, W. J., Scarboro P. O., Ont.
1914—Baker, M. H., St. Thomas, Ont.
1910—Barber, H. G., Interior Dept., Ottawa.
1916—Bartley, T. H., 441 Broadview Ave., Toronto, Ont.
1907—Bayne, G. A., c/o Hudson's Bay Company, Winnipeg.
1907—Beatty, D., Parry Sound, Ont.
1915—Beatty, F. W., Pembroke, Ont.
1912—Bennett, G. A., Tillsonburg, Ont.
1914—Beresford, H. E., Portage la Prairie, Man.
1915—Beresford, H. G., 859 Ingersoll St., Winnipeg.
1913—Berry, E. W., Thomas Blk., Calgary, Alta.
1910—Bigger, C. A., Dominion Astron. Observatory, Ottawa.
1909—Bingham, E. R., 418 Victoria Ave., Fort William, Ont.
1911—Blanchet, G. H., 110 Frank St., Ottawa, Ont.
1913—Boulton, W. J., Ottawa, Ont.
1907—Bourgault, C. E., Levis, Que.
1910—Bourgeault, A., St. Jean Port Joli, P.Q.
1912—Bowman, E. P., West Montrose, Ont.
1907—Brabazon, A. J., Interior Dept., Ottawa.
1907—Bray, L. T., Edmonton, Alta.
1910—Bray, S., Chief Surveyor, Indian Dept., Ottawa.
1910—Brenot, L., 137 Third Ave., Ottawa, Ont.
1910—Bridgland, M. P., 1950 Thirteenth St. W., Calgary, Alta.

Date of
Election. ACTIVE MEMBERS—Continued.

1912—Brownlee, J. H., Dawson, Yukon.
1913—Buchanan, J. A. 140 Jasper Ave., Edmonton, Alta.
1907—Burgess, E. L., Kamloops, B.C.
1912—Brown, Thos. W., Box 438, Saskatoon, Sask.

1912—Calder, J. A., Ashcroft, B.C.
1913—Cannell, H. W., Dept. Interior, Ottawa.
1915—Campbell, A. J., Sidney, B.C.
1911—Campbell, A. S., Cor. King and Brock Sts., Kingston, Ont.
1913—Carthew, J. T., Edmonton, Alta.
1909—Cautley, R. W., 523 Sixth St., Edmonton, Alta.
1912—Chase, A. V., Orillia, Ont.
1913—Christie, U. W., Interior Dept., Ottawa.
1910—Christie, Wm., Box 74, Prince Albert, Sask.
1917—Christie, G. M., Kamloops, B.C.
1914—Clarke, R. F.
1912—Clements, F. S., Box 49, Prince Rupert, B.C.
1909—Cleveland, E. A., Flack Block, Vancouver, B.C.
1910—Clunn, T. H. G., Interior Dept., Ottawa.
1909—Cochrane, M. F., Interior Dept., Ottawa.
1913—Coltham, Geo. W., Box 264, Aurora, Ont.
1907—Coté, J. L., Edmonton, Alta.
1913—Coté, J. M., Ottawa, Ont.
1914—Coté, J. A., Interior Dept., Ottawa.
1910—Cotton, A. F., Vancouver, B.C.
1912—Cowper, G. C., Ottawa, Ont.
1909—Craig, J. D., Asst. Supt., Geodetic Surveys, Ottawa.
1916—Crouch, M. E., 56 Lowther Ave., Toronto, Ont.
1913—Cummings, A. F., Fernie, B.C.
1910—Cummings, A. L., Cornwall, Ont.
1907—Currie, P. W., Interior Dept., Ottawa.

1911—Davies, T. A., Edmonton, Alta.
1911—Day, H. S., 1112 83rd Ave., Edmonton, Alta.
1908—Deans, W. J., Inspector of Surveys, Brandon, Man.
1912—de la Condamine, C., Box 1774, Calgary, Alta.
1911—Dennis, E. M., Interior Dept., Ottawa.
1912—Dennis, M., Interior Dept., Ottawa.
1917—Dennis, T. C., Geodetic Survey, Ottawa.
1907—Dickson, H. G., Whitehorse, Yukon.
1912—Dillabough, J. V., c/o Chief Engineer, N.T.R., St. Boniface, Man.
1909—Dodge, G. B., Interior Dept., Ottawa.
1913—Donnelly, Cecil, 343 Carlton St., Winnipeg, Man.
1915—Doze, J. W., Beaver Hills, Alta.
1913—Dozois, L. O. R., Box 1774, Calgary, Alta.
1910—Drummond, T., D.T.S., 119 St. Matthew St., Montreal.
1907—Dumais, P. T. C., Hull, P.Q.
1915—Dynes, R. F., Camrose, Alta.

1913—Edeskoly, Von J., 17 Inns. of Court Bldg., Vancouver, B.C.
1909—Edwards, Geo., Ponoka, Alta.
1913—Edwards, W. M., University of Alberta, Edmonton.
1913—Elliott, G. R., Calgary, Alta.
1907—Engler, C., Interior Dept., Ottawa.

Date of
Election. ACTIVE MEMBERS—Continued.

1912—Evans, S. L., Cabri, Sask.
1915—Ewan, H. J..
1914—Ewing, E. O., Toronto, Ont.

1910—Fairchild, C. C., 54 Brant Ave., Brantford, Ont.
1907—Fawcett, A., Gravenhurst, Ont.
1907—Fawcett, Thos., D.T.S., Boundary Surveys, Ottawa.
1914—Fawcett, S. D., 24 Fourth Ave., Ottawa.
1915—Finnie, O. S., Interior Dept., Ottawa.
1910—Ferguson, G. H., Commission of Conservation, Ottawa.
1911—Fletcher, J. A., Army P.O., England.
1915—Fletcher, W. A., Thornton, Ont.
1907—Fontaine, L. E., Inspector of Surveys, Levis, P.Q.
1913—Francis, J., Portage la Prairie, Man.

1911—Galletly, J. S., Peace River Crossing, Alta.
1909—Garner, A. C., 2133 Cameron St., Regina, Sask.
1908—Gibbon, Jas., 1631 Collingwood St., Vancouver, B.C.
1913—Glover, A. E., 140 Jasper Ave., West, Edmonton, Alta.
1913—Grassie, C. A., Medicine Hat, Alta.
1913—Griffin, A. D., 104 Walnut Ave., Winnipeg.
1907—Grover, G. A., 24 King St., West, Toronto.
1910—Gordon, M. L., 619 Hastings St., Victoria, B. C.
1914—Gourlay, Robt. M., 75 King St. E., Toronto.

1913—Hamilton, Chas. T., 1001 Rogers Bldg., Vancouver, B.C.
1911—Haggen, R. W., Revelstoke, B.C.
1914—Hardoin, Jos., France.
1913—Harris, J. W., City Engineer, Winnipeg, Man.
1910—Harvey, Chas., Kelowna, B.C.
1907—Hawkins, A. H., Listowel, Ont.
1907—Heathcott, R. V., Edmonton, Alta.
1913—Heuperman, L. F., Phoenix, Ariz., U.S.A.
1907—Henderson, F. D., Interior Dept., Ottawa.
1911—Herriot, G. H., Winnipeg, Man.
1911—Higgins, C. J., Box 1186, Vancouver, B.C.
1912—Hobbs, W. E., East Kildonan, Man.
1907—Hopkins, M. W., Edmonton, Alta.
1907—Hubbell, E. W., Secretary, Chief Inspector of Surveys, Dept. of the Interior, Ottawa.

1911—Inkster, O., Edmonton, Alta.

1909—Jephson, R. J., Box 986, Brandon, Man.
1913—Johnston, R. H., 10016, 108th st., Edmonton, Alta.
1911—Johnston, W. J., 1028 Standard Bank Building, Vancouver, B.C.
1912—Johnston, J. H., Peace River Crossing, Alta.
1915—King, J. A. S., 4 Howick Place, Ottawa.
1911—Kitto, F. H., Interior Dept., Ottawa.

1917—Lambart, H. F. J., Geodetic Survey, Ottawa.
1912—Latimer, F. H., Penticton, B.C.
1913—LeBlanc, P. M. H., Ottawa, Ont.
1910—Lemoine, C. E., 72 Mountain Hill, Quebec, P.Q.

Date of
Election. ACTIVE MEMBERS—Continued.

1911—Lighthall, A., 2328 Vine St., Vancouver, B.C..
1907—Lonergan, G. J., Inspector of Surveys, Buckingham, P.Q.
1912—Loucks, R. W. E., Delisle, Sask.
1907—Lumsden, H. D., 152 Argyle Ave., Ottawa.

1912—Martindale, E. S., Kings Mill, Ont.
1912—Martyn, O. W., Regina, Sask.
1911—Matheson, H., Sudbury, Ont.
1917—Meikle M., Ottawa.
1914—Morency, Geo., Levis, P.Q.
1914—Moran, P. J., 950 Jarvis St., Vancouver, B.C.
1917—MacTavish, W. H., Geodetic Survey, Ottawa.
1909—McArthur, J. J., His Majesty's International Boundary Commissioner, Ottawa. President.
1912—McCaw, R. D., Sidney, Vancouver Island, B.C.
1916—McCusker, K. F., Vars, Ont.
1917—Macdonald, C. S., 139 Stewart St., Ottawa.
1917—McCloskey, M. D., Topographical Survey Branch, Ottawa.
1912—McEwen, D. F., Grouard, Alta.
1910—McFarlane, J. B., 60 Lonsdale Road, Toronto.
1917—McGarry, P. J., Merritton, Ont.
1912—McKay, R. B., 1146 Pacific St., Vancouver, B.C.
1914—McKnight, J. H., Ottawa.
1913—McNaughton, A. L., Cornwall, Ont.
1913—McElhanney, W. G., Vancouver, B.C.
1907—McMillan, Geo., Finch, Ont.
1912—Melhuish, P., 2328 Vine St., Vancouver, B.C.
1913—Milliken, J. B., Dept. Interior, Ottawa.
1907—Miles, C. F., Calgary, Alta.
1909—Moberly, H. K., Yorkton, Sask.
1909—Montgomery, R. H., Prince Albert, Sask.
1909—Morrier, J. E., Prince Albert, Sask.
1907—Mountain, G. A. Chief Engineer to the Railway Commission, Ottawa

1911—Narraway, A. M., Topographical Surveys Branch, Ottawa.
1912—Neelands, R., Hamiota, Man.
1909—Nelles, D. H., Boundary Surveys, Ottawa.
1912—Neville, E. A., 936 Granville St., Vancouver, B.C.
1915—Norish, W. H., Topographical Surveys Branch, Ottawa.

1910—Ogilvie, N. J., Boundary Surveys, Ottawa.

1913—Parry, H., Interior Dept., Ottawa.
1912—Palmer, P. E., Ottawa.
1910—Parsons, J. L. R., Box 1004, Regina, Sask.
1910—Patrick, A. P., D.T.S., Calgary, Alta.
1910—Pearce, Wm., Calgary, Alta.
1913—Pearson, H. E., Box 1077, Edmonton, Alta.
1915—Perron, H. M., D.L.S., Edmonton, Alta.
1917—Perry, A. M., Ottawa, Ont.
1913—Peters, F. H., P. O. Box 2318, Calgary, Alta.
1907—Phillips, E. H., Regina, Sask.
1911—Pierce, J. W., Pembroke, Ont.
1914—Pinder, G. Z., Credit Foncier Bldg., Edmonton, Alta.

Date of
Election.

ACTIVE MEMBERS—Continued.

1911—Plunkett, T. H., Meaford, Ont.
1912—Powell, W. H., Vancouver, B.C.
1911—Purser, R. C., Ottawa, Ont.

1911—Rainboth, G. L., 315 Daly Ave., Ottawa.
1916—Rannie, J. L., D.T.S., Geodetic Survey, Ottawa.
1911—Ransom, J. T., Toronto.
1913—Reid, John, 161 Leonore St., Winnipeg, Man.
1907—Reilly, W. R., Regina, Sask.
1911—Rinfret, C., Topographical Surveys, Ottawa.
1915—Roberts, O. B., Minnedosa, Man.
1913—Robertson, D. F., Indian Affairs Dept., Ottawa.
1909—Rolfson, O., Box 378, Walkerville, Ont.
1907—Ross, Geo., Welland, Ont.
1910—Ross, J. E., Kamloops, B.C.
1907—Roy, G. P., 28 Lachevrotiere St., Quebec.
1911—Roy, J. E., 28 Lachevrotiere St., Quebec.

1908—Saint-Cyr, A., Ottawa.
1907—Saint-Cyr, J. B., 65 Laval Ave., Montreal.
1909—Saunders, B. J., Edmonton, Alta.
1910—Scott, W. A., Galt, Ont.
1909—Seager, E., Kenora, Ont.
1912—Segré, B. H., Toronto, Ont.
1912—Seibert, F. V., 10741, 126th St., Edmonton, Alta.
1910—Seymour, H. L., Interior Dept., Ottawa.
1907—Shanks, T., Asst. Surveyor General, Topographical Surveys Branch, Ottawa.,
1914—Shaver, P. A., Finch, Ont.
1912—Sheppard, A. C. T., Geological Survey, Ottawa.
1910—Shaw, C. A. E., Greenwood, B. C.
1912—Sirois, J. E., Box 26, Ste. Anne de la Pocatiere, Kamouraska, P.Q.
1908—Smith, C. C., Vancouver, B.C.
1907—Speight, T. B., 703 Temple Building, Toronto.
1912—Soars, H. M. R., 637 First St., Edmonton, Alta.
1909—Steele, I. J., Ottawa.
1912—Stewart, A. G., Hotel Cecil, Edmonton, Alta.
1912—Stewart, N. C., 2168 York St., Vancouver, B.C.
1911—Stewart, W. M., Saskatoon, Sask.
1917—Stewart, A. D., Ottawa.
1911—Stitt, O. M., 319 Pender St., W., Vancouver, B.C.
1913—Stock, J. J., Ottawa, Ont.
1911—Stuart, A. G., Buckingham, P.Q.,
1911—Street, P. B., 17 Spadina Road, Toronto.
1917—Tassie, Gilbert C., 1120 W. Pender St., Vancouver, B.C.

1914—Taylor, W. E., 323 Glen Road, Toronto.
1911—Taggart, C. H., Kamloops, B.C.
1908—Teasdale, C. M., Concord, Ont.
1913—Tipper, G. A., 196 Marlborough Ave., Brantford, Ont.
1912—Tremblay, A. J., Box 1077, Edmonton, Alta.
1907—Tyrrell, J. W., 7 Hughson St., Hamilton, Ont.

Date of Election. ACTIVE MEMBERS—Continued.

1911—Underwood, J. E., Saskatoon, Sask.

1913—Van Skiver, L. A., Demorestville, Ont.

1913—Waddell, W. H., Edmonton, Alta.
1911—Walker, C. M., Topographical Surveys Branch, Ottawa, Ont.
1911—Wallace, J. N., Box 1774, Calgary, Alta.
1914—Warrington, G. A., Public Works, Winnipeg, Man.
1913—Waugh, B. W., Interior Dept., Ottawa.
1907—Watt, G. H., Topographical Surveys Branch, Ottawa.
1907—Weekes, A. S., 540 Sutherland St., Edmonton, Alta.
1912—Whitcher, A. H., Ottawa.
1912—White, W. R., Indian Affairs Dept., Ottawa.
1912—Whyte, H. E., 926 N. Park St., Victoria, B.C.
1912—Wright, A. E., "Rusholme" Dundas St., Toronto.

DECEASED MEMBERS

Joined the Association.	Name.	Date of Death.
1907	Reid, J. L	June 18th, 1911.
1907	Selby, H. W	August 23rd, 1910. (Drowned).
1907	Stacey, A. G	June 4th, 1908.
1907	Young, R. E	October 24th, 1911.
1907	King, Dr. W. F., C.M.G	April 23rd, 1916.
1907	Holcroft, H. S	Died on Active Service, 1916.
1908	Green, W. T	November 1st, 1909.
1908	Ratz, W. F	February 6th, 1909.
1909	McLean, J. K	May 25th, 1913.
1909	Rainboth, G. C	November 2nd, 1910.
1909	Brady, James	
1910	Mackie, F. H	December 23rd, 1912.
1910	Robinson, E. W	August 14th, 1916. (Drowned).
1911	Earle, W. S	April 2nd, 1916. (Killed in Action).
1912	Ogilvie, Wm	November 13th, 1912.
1912	Hunter, A. E	July 14th, 1914. (Drowned).
1912	Ponton, A. W	January 21st, 1915.
1913	Johnson, C. E	December 31st, 1913.
1913	Carthew, W. M	June, 1916. (Killed in Action).
1914	Gass, L. H	April 8th, 1917. (Killed in Action).
1915	Bolton, L. E. S	June, 13th, 1916. (Killed in Action).

ANNUAL REPORT

OF THE

Association of Dominion Land Surveyors

Eleventh Annual Meeting

HELD AT

OTTAWA

ON the 30th and 31st JANUARY and 1st FEBRUARY, 1918.

OTTAWA:
Pattison Print, 370 Bank Street
1918.

ROLL OF HONOUR
DOMINION LAND SURVEYORS
WHO HAVE ENLISTED FOR
OVERSEAS SERVICE
1914-17

Alport, F.
Baird, W. J.
Ball, A. N.
Barton, H. M.
Barwell, C. S. W.
Beatty, F. W.
Beresford, H. E.
Berry, E. W.
* Bolton, L. E. S.
Bowman, E. P.
* Bowman, H. J.
Britton, G. C.
Browne, E. F.
Burwash, N. A.
Bush, C. E.
Calder, J. A.
Campbell, A. J.
Cannell, H. W.
Carroll, J.
Carscallen, H. R.
Carthew, J. T.
* Carthew, W. M.
Chilver, H. L.
Child, C.
Clarke, F. F.
Clark, R. F.
Clouston, N. S.
Cokely, L. S.
Cond, F. T. P.
Coursier, E. C.
Cumming, A. L.
* Dann, E. M.
Davidson, R. D.
Dawson, F. J.
Dillabough, J. V.
Donnelly, C. B
Draper, W. H.
* Earle, W. S.
Ellis, D. S.
† Elliot, G. R.
Evans, S. L.
Ferguson, G. H.
Fletcher, J. A.
Fletcher, W. A.
Garner, A. C.
* Gass, L. H.
* Gordon, M. L.
†* Graham, J. R.
Greene, P. W.
Greene, G. E. D.
Grover, G. A.
Haggen, R. W.
Hardoin, J.
Harper, C. J.
Harvey, C.
Heathcott, R. V.
Hobbs, W. E.
* Holcroft, H. S.
Hotchkiss, C. P.
Hunt, S.
Inkster, O.
Johnson, A. W.
Keeping, K.
Knight, S.
Lang, J. L.
* Latornell, A. J.
Laurie, R. C.
Logan, R. A.
Lyon, J.
* MacLeod, D. D.
‡ MacLeod, G. W.
MacKay, E. G.
MacPherson, A. J.
MacTavish, W. H.
Malcolm, W. L.
McArthur, A. S.
McCallum, G. H.
McCloskey, M. D.
McColl, S.
‡ McDonald, H. F.
McIntosh, J. S.
McKnight, J. H.
McLellan, R. A.
McLennan, A. L.
Meikle, M.
† Meikle, A. U.
Melhuish, P.
Menzies, J. W.
Moran, P. J.
Murdie, W. C.
Neelands, R. A.
Nelles, D. H.
Nesham, E. W.
Novion, L.
Palmer, P. E.
‡ Parsons, J. L. R.
Parry, H.
Pearson, H. E.
Perry, A. M.
* Pierce, B. C.
† Pinder, G. Z.
Pounder, J.
Ratz, J. E.
Riddle, J. M.
Robertson, D. F.
Robertson, E. D.
Rolfson, O.
Roy, J. E.
Saunders, B. J.
Scott, W. A.
Segre, B. H.
Seibert, F. V.
Sharpe, G. P.
Shaw, C. Æ.
Sheppard, A. C. T.
Sibbett, W. A.
Smith, D. A.
Smith, L. R.
Spence, W. A.
Steele, I. J.
Steers, F. P.
Stewart, A. G.
Stewart, L. D. N.
Stitt, O. M.
† Stock, J. J.
Swannell, F. C.
Tate, H. W.
Taylor, W. E.
Tremblay, A. J.
Van Nostrand, A. J
Vicars, J. R. O.
Vickers, T. N.
Waddell, W. H.
Wadlin, L. N.
Waugh, B. W
Whyte, H. E.
White-Fraser, G.
† Wilkin, F. A.
Wood, N. C.
Wrong, F. W.

* Died on Active Service. † Military Cross. ‡ D.S.O.

CONTENTS.

LIST OF ADVERTISERS.

OFFICERS FOR 1918—1919.

Patron:

E. DEVILLE, I.S.O., LL.D., D.T.S., SURVEYOR GENERAL.

Honorary President:

OTTO KLOTZ, LL.D., D.Sc., D.T.S., CHIEF ASTRONOMER.

President:

J. N. WALLACE, D.L.S.

Vice-President:

J. R. AKINS, D.L.S.

Second Vice-Presidents:

J. D. CRAIG, D.L.S., Ontario; P. T. C. DUMAIS, D.L.S., Quebec; W. J. DEANS, D.L.S., Manitoba; W. M. STEWART, D.L.S., Saskatchewan; F.V. SEIBERT, D.L.S., Alberta; J. E. ROSS, D.L.S., British Columbia.

Executive Committee:

G. H. BLANCHET, D.L.S., W. H. NORRISH, D.L.S., J. L. RANNIE, D.T.S.

Secretary-Treasurer:

E. W. HUBBELL, D.L.S.

SPECIAL COMMITTEES:

Publication and Publicity:

Duties—To prepare the papers for publication in the Annual Report and to attend to any publicity necessary.

E. M. DENNIS, D.L.S., H. G. BARBER, D.L.S., C. ENGLER, D.L.S., F .H. KITTO, D.L.S.

Geodetic Surveys:

J. L. RANNIE, D.T.S., W. M. DENNIS, D.L.S.

Topographical Surveys:

H. L. SEYMOUR, D.L.S., W .H. NORRISH, D.L.S., J. D. CRAIG, D.L.S. E. J. WIGHT, D.L.S.

Dominion Land Surveys:

Duties—To consider schemes and suggestions for improving the surveys.

J. W. PIERCE, D.L.S., J.R.AKINS, D.L.S., J. M. COTE, D.L.S., S. D. FAWCETT. D.L.S., R. C. PURSER, D.L.S., F. W. RICE, D.L.S.

Advisory:

Duties—To assist the other Committees and the Executive and to pay special attention to new classes of surveying and new fields of work.

A. M. NARRAWAY, D.L.S., G. J. LONERGAN, D.L.S.,

CONSTITUTION.

ARTICLE I.

NAME OF THE ASSOCIATION.

"The Association of Dominion Land Surveyors."

ARTICLE II.

OBJECTS OF THE ASSOCIATION.

The promotion of the general interests and the elevation of the standard of the profession.

ARTICLE III.

MEMBERS.

1. The Association shall consist of Active Members and Honorary Members.

2. Active members must be Dominion Land Surveyors, and only such shall hold office.

3. Any Dominion Land Surveyor may become an Active Member upon payment of the fees prescribed by Article IX.

4. Honorary Members must be nominated by two Active Members, and the nomination approved of by a unanimous vote of the Executive Committee. The nomination, with approval, must be in the hands of the Secretary-Treasurer at least one month before the Annual Meeting. They shall be elected by ballot in the manner hereinafter provided for the election of officers of the Association. The number of Honorary Members shall not, at any one time, exceed ten, and they shall be exempt from payment of dues.

ARTICLE IV.

1. The Surveyor General of Dominion Lands shall be Patron of the Association.

2. The officers of the Association shall consist of an Honorary President, a President, a Vice-President, a 2nd Vice-President from each Province, a Secretary-Treasurer, and an Executive Committee, all of whom shall be nominated at the General Annual Meeting.

3. Voting for officers shall be by letter ballot, which ballot will be issued by the Secretary-Treasurer to all members on or before the 20th day of March in each year.

4.. The ballots are to be returned to the Secretary-Treasurer on or before the 1st day of May, in each year, and opened by him.

5. Candidates and retiring officers are to be notified by the Secretary-Treasurer of the result of the election.

6. The Secretary-Treasurer is to have a vote only in the case of a tie.

ARTICLE V.

MEETINGS.

1. The Annual General Meeting shall commence on the last Wednesday in January, at Ottawa.

2. Special meetings of the Association may be called by the President, or by the President when requested in writing by three or more members.

3. Nine members shall form a quorum at any meeting for the transaction of business.

ARTICLE VI.

Any member of the Association who may desire a change in the Constitution of the Association, shall give notice of such contemplated change to the Secretary-Treasurer, at least one month before the next Annual Meeting, and the Secretary-Treasurer shall, in his notice of such meeting to the members, notify them of the name of the party proposing such change, and the nature thereof.

No by-law or rule shall be altered, or new one adopted, except at a General Meeting, and such amendment shall be voted upon at the said General Meeting, two-thirds majority of the votes cast being necessary for its adoption.

ARTICLE VII.

EXECUTIVE COMMITTEE.

1. The Executive Committee shall consist of the President, Vice-President, Secretary-Treasurer, and three members, and shall have the direction and management of the affairs of the Association. Three members shall form a quorum.

2.. The meetings of the Executive Committee to be held at the call of the President or Secretary-Treasurer.

ARTICLE VIII.

AUDITORS.

Two Auditors, to be elected by ballot, shall audit the accounts of the Association annually, and present their report of the same at the Annual General Meeting.

ARTICLE IX.

SUBSCRIPTIONS.

1. The fee for membership for Active Members shall be two dollars, payable in advance.

2. The fees of Active Members shall be forwarded to the Secretary-Treasurer with the ballot papers for election of officers, and any ballot unaccompanied by the fees mentioned in subclause No. 1, in case the said fee has not previously been paid, shall not be counted in the election.

ARTICLE X.

Whenever it shall be the desire of ten or more members of the Association residing within a radius of twenty-five miles of any local centre, they may petition the executive of the Association to form a local branch of the Association and submit their by-laws for the approval of the executive who are hereby empowered to deal with all matters relating to local branches.

BY-LAWS.

ORDER OF BUSINESS.

1. Reading of Minutes of previous meeting.
2. Reading of correspondence and accounts.
3. Nominations for Honorary Membership.
4. Balloting for Honorary membership.
5. Reports.
6. Unfinished Business.
7. New Business.
8. Nomination of Officers.
9. Adjournment.

2. All motions must be in writing, and shall contain the names of the mover and seconder, and must be read by the Chair before being discussed.

3. Reports of Committees must be in writing, signed by the Chairman thereof.

4. No member shall speak on any subject more than once, except the introducer of the subject, who shall be entitled to reply; every member, however, shall have the right to explain himself, subject to the discretion of the Chair.

5. When a motion has been finally put to the meeting by the Chairman, all discussion thereon shall be closed.

6. The Chairman shall appoint two scrutineers when a ballot is taken.

7. Every member, while speaking, shall address the Chair.

8. Parliamentary Rules to govern in all cases not provided for in preceding sections.

DUTIES OF OFFICERS.

1. The President shall preside at all meetings at which he is present; in his absence, the Vice-President; and in the absence of both, the meeting shall appoint a Chairman.

2. The presiding officer shall only have a casting vote, not a deliberate one.

3. The Secretary-Treasurer shall keep an accurate record of all meetings, conduct all correspondence, announce all meetings, receive all fees and subscriptions and other moneys, pay no bills, unless sanctioned by the Executive Committee and signed by their Chairman, make an annual report of all receipts and disbursements, and shall perform such other duties as may from time to time be assigned him by the Executive Committee.

ELEVENTH ANNUAL MEETING

Held at the Carnegie Library, Ottawa, 30th and 31st January and 1st February, 1918.

Members present at one or more sessions:—

Dr. Deville, I.S.O., Dr. Klotz, J. J. McArthur, R. H. Campbell, E. W. Hubbell, J. R. Akins, H. G. Barber, G. A. Bennett, G.H. Blanchet, W. J. Boulton, S. Bray, L. Brenot, R. F. Clarke, M.C., T.H.G. Clunn, M. F. Cochrane, J. M. Cote, J. A. Cote, G. C. Cowper, J. D. Craig, T. A. Davies, E. M. Dennis, W. M. Dennis, T. C. Dennis, G. B. Dodge, C. Engler, T. Fawcett, S. D. Fawcett, O. S. Finnie, L. E. Fontaine, F. D. Henderson, J. A. S. King, F. H. Kitto, H. F. J. Lambart, P.M.H. LeBlanc, G. J. Lonergan, E. S. Martindale, P. J. McGarry, J. B. Milliken, A. M. Narraway, W. H. Norrish, N. J. Ogilvie, J. W. Pierce, G. L. Rainboth, J. L. Rannie, C. Rinfret, H. L. Seymour, T. Shanks, P. A. Shaver, A. C. T. Sheppard, A. D. Stewart, C. M. Walker, G. H. Watt, A. H. Whitcher, W. R. White, A. E. Wright, E. J. Wight.

Others who attended:—

W. G. Addison, W. E. Allan, H. J. Bedard, C. W. Besserer, W. A. Birchall, J. D. Bradley, F. W. Brander, R. P. Bray, T. E. Brown, J. H. Byrne, R. Callander, D. H. Campbell, M. J. Carroll, H. K. Carruthers. N. Cauchon, D. E. Chartrand, A. S. Cram, R. M. Cram, A. A. Dion, A. J. Elder, D. J. Fraser, W. Gridley, K. D. Harris, S. N. Hill, G. Hollingsworth, W. G. Hunt, W. A. Johnston, G. S. Jones, A. Kilmartin, G. L. Kirwan, E. E. LaBarce, W. J. Lytle, W. L. MacIlquham, J. E. May, W. D. McClennan, A. J. McMillan, W. Miskell, W. E. Morgan, R. W. Morley, W. J. Moule, T. S. Nash, D. A. Nichols, W. J. Peaker, F. W. Rice, A. Roger, L. G. Smith, R. L. Squire, H. E. Sutherland, J. Sylvain E. E. D. Wilson, L. E. Wright, and others.

Carnegie Library Hall,
Ottawa, 30th January, 1918

FIRST DAY—MORNING SESSION

The President, Mr. J. J. McArthur, called the meeting to order at 10.15 a.m., and announced as the first order of business the reading of the minutes of the last meeting.

The Secretary, Major E. W. Hubbell,—The minutes of the last meeting are covered by the annual printed report, and as members have had an opportunity of reading them. I move that they be adopted as printed.

The motion was seconded by Mr. W. H. Norrish and carried.

The president called for the reading of correspondence.

The Secretary.—I suppose it is not desirable to read all the correspondence of the year. I have selected what I consider the most important files, and if it is the pleasure of the meeting I will read these.

This was agreed to without dissent.

The correspondence first referred to was that carried on pursuant to a resolution passed last year that the oldest member of the Association should be elected an honorary member. Mr. McFadden was written to advising him that this honour had been conferred upon him. But no answer was received nor was the letter returned.

Letters had been written to the Minister of the Interior urging the justice and desirability of conferring upon Dr. E. Deville, I.S.O., LL.D., D.T.S., the further degree of C.M.G. A reply was received from the then Minister, Dr. W. J. Roche, expressing thanks for the suggestion coupled with high appreciation of Dr. Deville, and promising to refer the matter to his colleagues of the Cabinet.

A letter was read in which the Association applied to the Minister of the Interior for an increase of its government grant from $125 to $200; the reply of the Minister was also read.

Correspondence was read on the subject of a visit to the Comparator Building of the Topographical Surveys Branch.

Mr. H. L. Seymour, being called upon to speak in connection with this matter, explained that in the absence of the secretary from the city this matter had been left in his hands. The visit to the Comparator Building was made at the invitation of the Surveyor General. A large number of Dominion Land Surveyors had taken advantage of the opportunity to inspect the building and appliances and many had afterwards expressed themselves as having greatly enjoyed and benefited by the visit. He thought the members of the profession were greatly indebted to Dr. Deville, Mr. Dodge and Mr. Way, for this opportunity to visit the Comparator Building and for the demonstrations given.

The Secretary continuing the reading of correspondence, told of letters sent out by him asking firms dealing in goods needed by surveyors to advertise in the Annual Report, but said that the business secured amounted only to $38.

Letters were read from sister associations acknowledging receipts of the Honour Roll of the Association containing the names of members who had volunteered for overseas service.

The letter of condolence sent by the Association to the widow of the late Dr. W. F. King, Dominion Chief Astronomer, was read together with Mrs. King's acknowledgment.

Letters were read that had been sent to the Minister of the Interior and others in authority offering the services of the Association and its members in connection with the war, together with acknowledgments of the same.

A letter was read which had been sent by the Executive offering the services of the Association and its members in connection with the projected work of the Soldier Settlement Board. Copies of this letter had been sent to the Minister of Militia, the Minister of the Interior and the Head of the National Service Board, and, when the present government came into office, to Hon. Mr. Meighen, Hon. Mr. Calder and Hon. Mr. MacLean, from all of whom acknowledgments had been received.

A circular letter was read which the Association had sent to Surveyors, asking for suggestions as to the work of the Association, and also replies to the same as follows:

FROM R. H. KNIGHT, D.L.S.

I beg to forward the following concerning survey pits, which form such important parts of the corner monument.

No other part of Dominion land surveys has caused surveyors such trouble in the field as the mounding, and I venture to suggest that no other branch of the field work has caused so much annoyance to the Surveyor-General's office staff, as that same mounding work.

I am not aware that the size or shape of the pit was ever discussed at any of the annual meetings of the Association. It is such an innocent little thing that it has probably been overlooked and has not received its due attention. Pardon me therefore for introducing such a small matter at this time.

"Three feet square, eighteen inches deep." This makes an easy description, a pretty picture, and a big hole.

When it is considered that from seventy to one hundred thousand of these holes are dug annually, and since they are the source of such trouble it might be well to discuss the pit at this time and place.

I respectfully submit that the vertical face of the pit, as now required, would be better if it were made with a slope.

Two chief reasons for the sloped sides are:—To prevent caving and to lessen the labour in digging the pit. Very rarely, except in dry muskeg will the pits retain their vertical face after being exposed to the elements for any considerable length of time. The sides cave in, and within two or three years the pit instead of being 18 inches deep and 36 inches square is generally about 12 inches deep and 42 inches square at the top, with a ragged and more or less irregular shape. Comparatively loose earth will not retain a vertical face and it is never expected to.

The cubical contents of the pit that is at present being made is about correct. Suppose that the pit was made 42 inches square at the top and 30 inches square at the bottom. The cubic measurement would be approximately the same. The slope of the side would be one in three which would practically prevent caving. The pit in most cases would retain its clear cut shape at the top and would not be filled at the bottom.

Most surveyors have done more or less mounding and know that it is the hardest and most disagreeable work to be performed on the survey. They also know that in digging a pit in average soil, there is as much labour expended in digging out the bottom 4 or 6 inches as there is in taking out the upper 12 or 14 inches of the pit. If therefore a sloped pit were adopted the labour of digging would be greatly reduced, for the upper half of the pit would contain about 8 cubic feet while the lower half would contain about 5.5 cubic feet.

Besides making a pit that would be more easily dug and that would retain its shape, much of the field trouble of getting workmen to make vertical sides on the pits would be disposed of.

FROM A MEMBER.

Regarding Spare Transit.

Whereas, in connection with Dominion land surveys, the regulations at present state that "a spare transit is recommended", and whereas, upon most surveys, a spare transit is essential, and upon subdivision surveys it is a necessity, not only for cases of accident but for convenience in observing and economy in traversing; and whereas as a large proportion of articled pupils have had but little experience in the use and care of a transit, and the surveyor in charge of subdivision or traverse surveys is now required to supply such a transit, and since it is a hardship upon the surveyor to place his good transit instrument into the hands of a green man or possibly into the hands of a careless man;

Therefore it is suggested that it be recommended to the Surveyor General that either the articled pupil supply a transit of an approved pattern, and that his present salary allowance be increased sufficiently to provide for such, or that the spare transit be supplied by the Department in the same manner that the level is now supplied.

FROM F. H. WRONG, D.L.S.

Could not a scale of feet in tenths and hundredths be printed in convenient form in the transit book ?

In view of the accuracy desired I would suggest that it might be well to try to have all measurements made using a tension handle of small dimensions and convenient form for field use. One similar to that furnished with the standard but recording up to fifty pounds pull would do. Personally I should like to hear this subject of correct chaining methods discussed, and also the best system of making tests in the field with the standard so as to obtain the equation of the personal error of a set of chainers where no tension handle is used on the regular chainage, especially as ten pounds is not sufficient tension to use on the standard one-chain tape for checking a half mile when the chain is freely suspended, and it is impossible to have it fully supported as in the official test at Ottawa.

With reference to accurate instrument work it might interest some to know that the inaccuracy of picketing in the bush may be obviated by giving the picket man a plumb-bob. The instrument man in giving a station, lines in the top of the picket, and the picket man places his points on the ground from that.

I have seen this method work out with great satisfaction considering both accuracy and speed where it is impracticable to use a straight picket with an iron point.

Relative to the field work under the present system, could not regulations be amended to allow the subdivider to turn off all the meridian lines from the base line and run these north or south three miles to the control chord. I think that this would help the surveyor and if the base lines are accurate, it should not affect the accuracy of the survey ?

FROM H. M. R. SOARS, D.L.S.

May I suggest that the surveyors in charge of parties should impress most strongly on the men in their employ the necessity of not tampering with the lines of traps and snares set by white and Indian trappers, as the latter might retaliate by burning or robbing a survey cache.

In any case it is well to be on good terms with men whose knowledge of the country is most valuable.

FROM J. K. BENNER, D.L.S.

At present when a closing is made on a previously established corner, a bearing is calculated for the last half mile that will connect the quarter section corner with the corner closed on. As the settler usually considers the lines as run on the ground to be the boundaries of his property I would suggest that the last half mile in such cases should not be blazed when the line is first run and if it does not close on the corner, that it should be offset so as to do so. This could be done without much extra work, because in closing on such corners the party generally has to walk back along the line run, to make the connection to get at other work, and the line could be re-run as they walk back.

A letter was read from Mr. Collingwood Schreiber, C.M.G., regretting his inability to attend the present meeting of the Association.

All the correspondence above referred to was ordered to be received and left for such further action as the Association might decide upon.

Mr. J. J. McArthur, President, read his Presidential Address as follows:

PRESIDENT'S ADDRESS.

GENTLEMEN OF THE DOMINION LAND SURVEYORS' ASSOCIATION:—

Allow me first to thank you for the honour done me at last annual meeting in electing me to the Presidency.

It is with regret that I have to mention the death of one of our oldest and most respected surveyors, P. R. A. Belanger. His active career had extended over a period of nearly forty years, during all of which time he was engaged on most important work. His name deserves a prominent place on the roll of honour in the Government service. It will be in order for some member to move a resolution expressing our sympathy, the same to be forwarded to his wife and family.

During the year ten names have been added to the number of enlistments for Service Overseas, bringing the total up to 136. We have reason to be proud of the part our men are taking in the struggle in France and Flanders. The Secretary will probably give some particulars in his Report.

It is gratifying to learn that the "New method of Subdivision" introduced last season, on Dominion Land Surveys, has proved to be a great improvement on the old system.

Peace does not seem near, and the longer it is delayed, the greater will be the problems of readjustment. In solving these problems, Surveyors must be prepared to take a hand. In our western country, which has been the scene of our labors for nearly fifty years, there is no class of men better equipped to advise and assist in the administration of the Departments which will have to deal with the questions of immigration, and the placing of returned soldiers on the land.

Those who have been actively engaged in the survey of Dominion lands during the last ten or fifteen years, are mostly young men, of proved executive ability and integrity. They have been closely in touch with the pioneer settler, and have witnessed his struggles and successes, and sometimes his failure; and no one is better qualified to advise as to improved methods of settlement. Things will never again be as they were, and the period during re-adjustment will be a critical time. The future welfare and happiness of the country demand that the work of carrying out the policies of the Government should be in the hands of experienced, practical men.

Already the theorist is at hand with his Utopian schemes and paternal policies. Mistakes will be far reaching and rectification difficult or impossible.

I would recommend the naming of a strong Committee of the young men to watch the trend of events, and so prepare that when the time comes, they will be in a position to successfully urge their claims to serve in important positions, for which they are pre-eminently fitted.

If you would secure anything in these times you must go after it.

Thanking you for your kind attention.

J. J. McARTHUR.

In the course of his address the President laid aside his notes for the time and spoke extemporaneously:

GENTLEMEN,—The Ministers and others do not seem to have grasped what we are after. They think we are after increases of salaries or promotions in the Service—that is the tenor of their remarks. They do not seem able to appreciate that our object is to serve—they do not get our point of view. If the committee of which I have spoken is appointed, I hope they will go into this matter more fully and try to make known to these public men our position exactly as it is. We are not after spondulicks; our idea is service. But they do not grasp that, but think we are asking for something for ourselves. We must try to educate. (Applause).

The Vice-President, Mr. T. Shanks, was called to the chair. Mr. T. Fawcett spoke in appreciation of the services rendered to the Association by the President and moved a vote of thanks in acknowledgment of the benefits which the Association had received thereby, and in the course of his remarks also spoke in praise of the late Mr. Belanger, who had been mentioned in the President's address. The motion was seconded by Mr. Seymour and was heartily supported by Mr. Shanks who, speaking as a member of the Executive, paid a tribute to the services Mr. McArthur had rendered. The motion was carried amidst loud applause.

The President then resumed the Chair and called for the reading of the Secretary's report.

SECRETARY-TREASURER'S REPORT.

THE SECRETARY,—Before I read my report, I beg to move: That this Association place on record its sincere sorrow in the death of Mr. Belanger, and that a letter be sent to his family expressing our sympathy in their loss.

Mr. Belanger's death was sudden and unexpected. I have worked with him in the office and in the field, and I found him conscientious and earnest in his work for the Department and just and upright in all his dealings.

Mr. T. SHANKS.—I think I should fail in my duty if I did not say something as to the public work of Mr. Belanger. He was one of the surveyors under whom I served. I was with him in 1901. I heartily endorse the statements of Mr. Hubbell and Mr. Fawcett concerning him. He was one of the most conscientious public servants I ever met. I heartily second the resolution.

The resolution was carried by silent vote.

The Secretary-Treasurer read his report as follows:

Ottawa, January 30, 1918.

MR. CHAIRMAN,—

I have the honour to submit herewith a report for your consideration, respecting the business of this Association during the past year, ending 30th January, 1918.

After the minutes of the last session had been revised, and the reports and miscellaneous papers comprising the Proceedings at the Annual Meeting collected, they were placed in the hands of R. J. Taylor, Printer, Ottawa, for publication. Five hundred (500) copies of the report were printed at an average cost of 86¾c per copy, an increase of 19¾c per copy over the previous report. This apparent high cost, is due to the increased cost of printing material and labour; also to the large number of illustrations.

The reports were ready for distribution at the end of May and copies were mailed without delay to all members of the Association in good standing.

Exchange of reports was arranged between our Association and the Ontario and the British Columbia Surveyors' Associations.

Reports Received

1917	—Ontario Land Surveyors' Association..	100	Copies
1917	—British Columbia " "	6	"
1916-17	—Manitoba Land " "	2	"
1917	—The Transvaal, Journal of the Institute of Surveyors	1	"

Reports Sent Out

To Ontario Land Surveyors' Association...	130	"
" British Columbia " "	6	"
" Alberta Land " "	10	"
" Quebec Land " "	1	"
" Saskatchewan " "	25	"
" New Zealand Institute of Surveyors..	1	"
" Transvaal " " "	1	"
" Members of the Dominion Land Surveyors' As.	200	"
" Manitoba Association of Land Surveyors..	2	"
" Complimentary (Universities, Libraries, Advertisers, honorary members, etc., etc)......	52	"
Copies on hand....	72	"
	——	"
Total	500	"

The reports received from the Ontario Association were mailed to all members of our Association who are not members of the Ontario Association.

We appreciate and are duly thankful to our sister associations for the valuable information contained in these reports. They are kept on record in the office and are at the disposal of any member of the Association at any time.

Our thanks are also due the Commission of Conservation for a copy of each of their valuable publications received during the past year, and to Mr. J. W. Harris for a copy of the report of the Board of Valuation and Revision on Systems of Assessment and Taxation (City of Winnipeg).

During the past year a large number of letters and circulars were sent to surveyors and others interested in the progress of the profession.

Letters Received and Sent Out

Letters received..	155
Letters sent out	430
Circulars (Aims of Association, etc.)	350

"	(re fees) (2)	275
"	(re meetings)	100
"	programmes	150
Ballots		180
Pamphlets (re Returned Soldiers)		500
Total		1985

During the year 1917, the names of 25 members were struck off the active list on account of non-payment of fees, in accordance with a ruling of the Executive.

Forty-two (42) of our members on active service are exempt from payment of fees, thus causing a reduction in revenue of $84.00.

Twenty-one (21) new members were enrolled during the year.

The official list of active members has been revised from time to time and now stands as follows:

Honorary members	9
Active members	217
Total	226

Five meetings of the Executive were held during the past year at which great interest was shown by the members of the committee in the various questions under discussion. Among the principal topics discussed was "The Returned Soldier Settlement Scheme", the chief characteristics of which are ably shown in the following memorandum prepared by Mr. H. L. Seymour, D.L.S.:

"Realizing the importance of all settlement projects or plans to the public and to surveyors alike, the Executive have in the past year engaged in some correspondence and interviews with government officials. Our hope is that we have slightly shaken that apparently deep rooted conviction that beyond the actual measuring of areas to be settled, the surveyor can take no further part in settlement.

Our attention was first directed to the appointment of Dominion Land Surveyors to assist Dominion Lands Agents in the various land districts of the West, and we urged that, should new agencies be created, surveyors should be considered as agents rather than have appointments made as in the past. Our request was not seriously considered. On the return of our President, Mr. J. J. McArthur, absent on official business, he explained that a similar request had been made years ago without result.

The National Problems Club, with headquarters at Toronto, requested the Executive to express themselves on the matter of Soldier Settlement. The writer was commissioned to prepare a report which the Executive graciously recommended to be sent.

Since the Soldier Settlement Act was mooted in the Federal House, the Executive have endeavoured by correspondence and interviews to show to the Government the necessity for having qualified surveyors appointed to the Board and attached to the staff. It would seem that a surveyor is not to be one of the three Commissioners, none of whom at the time of writing is officially appointed. We still may and do hope for the appointment of surveyors to the staff provided for by the Act."

As the expenses of the Association are gradually increasing owing to reasons previously stated, and the revenue decreasing, it is feared that unless some means are adopted to increase the revenue or decrease the expenditure the Association will hardly have sufficient funds to meet current expenses.

Two methods might be considered to remedy this deficiency, namely to increase the fees for 1918 to $3.00, or to obtain an increase of say $125.00 in the Government grant.

The expenditure for the year exceeded the revenue by $143.07.

Revenue for the past year	$554.88
Expenditure for the past year	697.95
Deficit	$143.07

FINANCIAL STATEMENT, 1917

RECEIPTS

Balance in Bank	$358.91
Cash on hand	9.79
Advertisements	36.00
Dinner Tickets 37 @ $1.50	55.50
Annual fees 1913 @ $2.00	2.00
" " 1914 " "	10.00
" " 1915 " "	40.00
" " 1916 " "	80.00
" " 1917 " "	174.00
" " 1918 " "	20.00
" " 1919 " "	2.00
" " in arrears, at reduced rate offered by Executive	3.00
Government Grant	125.00
Interest	6.48
Commission on cheques	.90
	$923.58

EXPENDITURE.

Chateau Laurier Annual Banquet, 1917	$97.00
Tip to waiter	2.00
Tip to caretaker library	1.00
Stenographer's report of meeting	30.00
Printing Annual Report	433.75
Printing Stationery, circulars, etc	41.00
Grant to Secretary-Treasurer, 1917	75.00
Advertisement in papers re meeting	10.35
Stamps and war stamps	1.00
Express charges on O.L.S. Reports	1.00
Discount on cheques	2.40
Transfer and services re lantern	2:50
Rubber Stamp and cards	.95
Bank Account	217.94
Cash on hand	7.69
	$923.58

Audited and found correct.

E. M. DENNIS,
G. C. COWPER,
Auditors.

January 28, 1918.

ESTIMATE OF EXPENDITURE FOR 1918

Printing Annual Report	$350.00
Reporter	75.00
Printing circulars, stationery, etc.	30.00
Miscellaneous	20.00
	$475.00

ESTIMATE OF RECEIPTS FOR 1918

Advertisements	$35.00
Fees 1918 (last year $174.00)	150.00
Government Grant	125.00
Arrears (last year $130.00)	100.00
	$410.00

Respectfully Submitted,

E. W. HUBBELL,

Secretary-Treasurer.

Mr. T. Fawcett.—We are greatly indebted to Major Hubbell for the clearness with which everything is set forth in his report. As to the expected deficiency in our revenue, I think that can be met in only one way, and that is the way in which the Ontario Association have met a similar situation. They have increased their annual membership fee from $4 to $5. I think we should follow their example and increase our annual fee by $1 a year.

Mr. Dodge.—I am afraid that an increase in the fee will be found unpopular. My suggestion is that we should cut down our expenditure.

Mr. Seymour.—The largest item of expense seems to be the publication of the Annual Report. I suggest that the new Executive consider means to reduce that expenditure.

Mr. Dodge.—The publication of the Annual Report accounts for only about half the year's expenditure.

Mr. Seymour.—But if the Report were not published the Association would have quite a cash balance. As the publication of our Report is a benefit, direct or indirect to the public, I think the incoming Executive should ask the Government for an increased grant to meet the expenditure.

The President.—I think Mr. Seymour's suggestion is best.

Everything done by this Association is really for the benefit of the people of Canada. A grant of $125 to such an Association as this, is very small and if the matter is presented in the right way to the Minister of the Interior, I think he will be willing to recommend an increase. I recommend that a committee be named to interview the Minister on the subject.

The Secretary.—It has been suggested that the expenditure for the Annual Report is only half the expenditure of the Association. Last year the amount spent for printing the Annual Report and circulars was $475, and the total revenue was only about $700. The estimate for the cost of printing this year's report is $350. It is thought that by cutting down the number and expense of illustrations the cost can be reduced as compared with last year. If our estimate of receipts is realized the income for next year will be $410. Besides we have $224 in the bank. Our estimate of total expenditure is $475. So it appears we can meet the expenses of the year, but to do it we must use up part of our surplus.

Mr. Pierce.—I think that the Dominion Land Surveyor who does not feel that he can afford to pay at least $3 a year for membership in the Association is not sufficiently conscious of the advantages which the existence of this Association brings to the profession. I do not know that it would be possible to make employment depend upon membership in the Association, but I think it would be a good thing if that could be brought about. As to the proposal to increase the annual fee, everybody knows how prices are increasing, and it is to be assumed that the expense of running the Association is increasing also. If we can get an increased grant from the Government so much the better. If not, I would be in favour of an increase in the fee.

The Secretary.—This question of finding a sufficient revenue for the Association is a worrying one. We have the satisfaction, such as it is, that we are not the only organization to feel the pinch of the present times. The Ontario Land Surveyors' Association spent $430 more than its revenue. It is to be remembered that we have upwards of forty-five members at the front, whose membership is continued without the payment of fees. A number of our members have had to be struck off the roll for non-payment of fees. Had these members paid their dues we should not have been in our present position. There are a number of members who are years in arrears. As members they have the benefit of the work of the Association and they have accepted the benefits of membership. The position of these people was discussed last year by the Executive and it was decided to send a circular offering to compromise with them on a fifty-fifty basis—to reinstate them on payment of half the amount due. Some paid on this basis while others did not, and some did not even acknowledge the circular. To call on the members for an increased fee would be a thankless job. The number of circulars sent out last year was double the number sent out the year before. The Executive is anxiously considering this whole matter. Our Report of last year cost 87 cents a copy. I do not think that any similar Association issues a better report than ours. Personally, I doubt the advisibility of increasing the fee. I think your suggestion is a good one, Mr. President—that we should appoint a committee to wait on the Minister. When our grant was set at its present figure forty cents was worth as much as a dollar is worth to-day. Our grant ought to be at least double.

Mr. Dodge.—As the Executive has estimated $350 for the Annual Report as against $475 for Annual Report and circulars last year, I presume they must have had information to go upon. We all know that the cost of printing has gone up since last year. What was the expenditure for the Annual Report last year ?

The Secretary. —It was $430.

Mr. Dodge.—Did the Executive get estimates from the printers on which to base its estimates for this year ?

The President. —A great part of the cost of the Report is for the illustrations used.

Mr. Dodge—I am inclined to think that the cuts are furnished to surveyors who read papers, free of cost. In handling another report, I have learned that the cost of printing is half as much again as it was last year.

Mr. Shanks.—I think that we all admit that the prospect is not too rosy. For 1917 our receipts for annual fees were only $174. In addition we had the Government grant of $125. It costs us a good deal more than the total of these two items to pay the cost of printing our Annual Report. I think the Association has reached a stage where we must consider seriously whether we are able to pay our way or not. I certainly am not in favour of our doing as an Association what I would not do myself—run into debt. But we are in a fair way to get into debt if we spend our money as we have spent it in the past. We must get an increased revenue or we must discontinue the publication of our Report. Personally, I am quite willing to pay an increased fee, but on the other hand, I do not care to pay an increased fee for the benefit of those who do not pay any fee at all.

Mr. King.—There are a number of Reports left over. Is it necessary to have so many printed ?

The Secretary—We have more copies left over this year than in former years because we have not sent so many to other Associations with whom we exchange. Formerly we sent 150 copies to the Ontario Association, but this year we have sent only 130. But a reduction in the number of the Reports would not bring about a very great saving in expense.

The President.—Would it not be possible to publish a much smaller Report or omit publication for a year ?

Mr. Seymour.—I understand that our grant of $125 is contingent on our publishing a Report.

Mr. Dodge.—The Report is the only thing that the outside members get for their fees. Personally I should be sorry to see it dropped. The estimates for 1918 show a deficit of $140, but it seems to me from the figures given that the actual deficit is likely to be nearer $300.

Mr. President.—I do not see any way out of the difficulty except either to publish a smaller Report or else secure an increased grant. There can be no question that the publication of our Report is in the public interest and I cannot see why the Dominion Government should not increase our grant.

Mr. Engler.—I see the force of what Mr. Dodge says that the outside men get nothing for their fees except the Report. But I do not see why we should not compromise—omit publication one year and then publish a Report of two years. If the idea were presented to the Government they might be willing to continue the grant to the Association on this basis.

Mr. Rannie.—Nobody seems to have suggested that we might increase our revenue by decreasing our annual fees. It works out that way sometimes.

Mr. Secretary.—One year we did not have our Report printed and it was by that means that we accumulated a small surplus, which can be used to make up the deficiency in our revenue this year. The Executive this year thought we could limit the expenditure to $350.

Mr. Shanks.—I think we may assume that the estimate given by the Secretary has received his careful consideration. As a member of the Executive I am not responsible for the estimate. I would like to see the estimate of expenditure considerably reduced. As to the Annual Report, I would like to see it printed if we can pay for it, but not otherwise. If we do not print it this year we do not get the grant of $125. But why not print $125 worth of Report? If we should publish no Report this year and a double Report next year we should have a greatly increased expense and only $125 as a Government grant for two years.

Mr. T. Fawcett.—I understand we have the money in sight to pay for the publication of our Report this year. But I think we ought to decrease the cost of publication by decreasing the size of the Report or in some other way. The cost of printing is governed not so much by the number of copies as by the size. Once the type is set and the book ready for the press the cost of printing and binding is small. If we publish $125 worth as suggested our Report would be very small.

Mr. Norrish.—If we did not publish the Report and still pay a fee of $2, we shall have a considerable surplus. It seems to me we ought to publish our Report even if we do use up some of our surplus in doing it.

The Secretary.—If we publish a Report of the cost of only $125 or $150 it will not be nearly of the same value as the Report we usually get out.

The President.—I do not think the Government would insist upon the publication of the Report as a condition of paying the grant. The grant is given to encourage the Association in its work, and even if we did not publish a Report the $125 would still be available.

The Secretary.—I am expected to furnish the powers that be with a statement showing the cost of printing our Annual Report. I send in the account that is sent me by the printer. Then, after due time for consideration and a good deal of red tape they send us $125.

Mr. Engler.—I think it quite possible to reduce the size of the Report without lowering its standard. There is usually a lot in the Report that I do not read. For instance, if you publish what has been said this morning I shall not read it, but if the Report contains good scientific papers, I will read it.

The Secretary.—It must be borne in mind that we are not one or two members but many members. I have received letters from members saying: "Why don't you publish the discussion that goes on in the meeting? We want to know what is said down there." Here you see the difference of opinion that exists. I think we should appoint a committee to consider this whole question of revenue and expenditure and report at a subsequent meeting.

After discussion a committee on the above subject was appointed consisting of Messrs. Pierce, Fontaine, King and Bennett, with Mr. Pierce as Convener.

The meeting adjourned until 2·30 p.m.

FIRST DAY—AFTERNOON SESSION.

The President resumed the Chair at half past two o'clock and called upon the first speaker.

Mr. H. K. Carruthers read a paper on Field Photography:

FIELD PHOTOGRAPHY.

BY H. K. CARRUTHERS, CHIEF PHOTOGRAPHER OF THE TOPOGRAPHICAL SURVEYS BRANCH.
(Department of the Interior.)

As my paper this afternoon includes tank development, I thought it would appeal to the majority present if a practical demonstration of developing was made before you. This operation requires about twenty-five minutes, so in the meantime I will continue my talk.

(It was here shown how the film was prepared for the developing tank. Developing powders were dissolved in the proper quantity of water and the film immersed.)

My talk this afternoon on Field Photography is for the purpose of encouraging the taking of pictures by the different survey parties engaged on Dominion Land Surveys.

It has always been my opinion that the surveyor is the proper person to undertake this work because he is generally first on the ground, and again he is better able to judge what scenes will be of most value to this office.

At the last Annual Meeting of this Association the opinion was voiced by several speakers that in the very near future surveyors would be asked to enlarge their scope of work by taking in a more detailed survey of the country regarding its soil, timber, mineral wealth, waterpower, etc. How much more valuable then will his report be when accompanied by a series of first-class photographs ?

Taking pictures to-day is a very simple matter when compared to former years. Note the high quality lenses, the complete equipment and the lightness and compactness of the film roll. Compare this latter advantage with glass plates of the same size, together with their weight and risk of breakage.

I am talking to some surveyors who have made a failure of photography in the field, and judging by the results of some of their work, no offense should be taken. I am also cognizant of the fact that there are others present who could better take my place this afternoon.

Before starting out on this year's work I would advise each one of you to accept our offer of a free course in field photography at the Surveyor-General's office.

This course will include the exposure of the films, preparing the roll for tank development, the developing of the roll, fixing, washing and drying the negatives.

Each kodak, whether new or old, should be tested for accuracy of focus before going on a long trip. On several occasions we have made these tests and found the distance scale out by the aid of a microscope. (The method of making this test was here illustrated,).

The majority of films developed in our office show first, a lack of proper judging of distances—a poor excuse for a D.L.S.—secondly, an unsteadiness in holding the kodak,—also a poor excuse in a prohibition country,—and third, a seemingly underexposed or underdeveloped negative.

The first cause can be minimized by pacing each distance, if the subject to be photographed is closer than 100 feet.

Over that distance the infinity or 100-feet mark will suffice.

I am pleased to be able to illustrate the latest 3A kodak sent out by the Canadian Eastman Kodak Co.. This camera shows the new view finder, a vast improvement over the old criss-cross style, which is confusing to one when taking a vertical picture directly following one taken horizontally.

Another improvement, and I consider it next in importance to the lens, is the new range finder. With this attachment the surveyor will reduce to a minimum, his first trouble, that of unsharp definition. At the present time it is impossible to have this new finder attached to your present kodak as it requires a completely new lens front, and again, the company cannot turn these new models out fast enough to supply the demand,

(Here followed a detailed verbal account of how the range finder was manipulated..)

Lenses supplied with each kodak are supposed to cover the whole film with sharpness of definition at open aperture.

It is sometimes the case that the mounting of the lens on the kodak front is not exactly parallel to the film. This is corrected to a high degree by stopping down the diaphragm.

In a large copying camera capable of taking negatives 24″ by 36″ this would be a serious matter and would have to be corrected by adjusting the lens board.

Experts of the Eastman Kodak Co. have come to the conclusion that films larger than post card size are unsatisfactory, owing to the cockling of the film when stretched across the back. They have discontinued manufacturing these sizes, which proves conclusively that these cockles interfere with the definition.

In focusing on groups or large buildings at a known distance it is advisable to add 10 or 15 feet on your focusing scale, as this results in greater depth to your pictures. The unsteadiness of the camera shows in some films, the picture looking as if the whole universe had suddenly moved. This is also caused by exposures being made in too hasty a manner. Another common fault of the amateur is to hold the kodak too close to his body.

Whenever possible use a tripod. It requires only a few seconds to erect. I have here before me the folding, telescopic, metal tripod supplied by the office, and another of later design with a revolving head. This is an advantage in locating your view.

Many seemingly improperly exposed negatives are not entirely due to the fault of the surveyor. Upon investigation it has been discovered that a chemical action takes place immediately following exposure, and the longer a film remains undeveloped the worse the deterioration becomes. Films are sent out in hermetically sealed cans with enclosed directions not to return the film to the can after once removing the same, for the moisture which it will have absorbed, if it is again returned to the can, will do more harm than if the film is left in the open air.

To prevent this deterioration, tank development will have to be adopted in the field, and I am going to explain, this afternoon, how simple and convenient this method is.

For the past number of years a great many of you have been sending in some pretty poor films. Personally I felt you were capable of doing better if the subject were given a little study.

The Eastman Kodak Co. warns us not to delay development after exposure, and therefore you yourselves are partly to blame in keeping your films until the close of the season.

I have with me the kodak which the late John Woodruff used on all his more recent photographic tours. His method was to develop every night and rephotograph, if possible, the next day, all exposures that were unsatisfactory.

The developing tank and loading box occupy very little space and should be included in your regular equipment.

When to do this developing will rest with yourselves. When your roll is fully exposed, develop that night, or do it once or twice a week.

Possibly no part of photographic work presents greater difficulties to the novice than the estimation of exposure, whilst the more experienced worker striving for perfection can hardly devote too much time to acquiring a complete knowledge of the subject.

A large number of exposures made both by amateurs and professionals are of such a haphazard nature that the operator can seldom say with certainty what the result will be until the picture is developed. At the same time there are so many factors to take into consideration that it would be impossible to make rules to cover every contingency.

Therefore I would advise that a record be kept of each film covering its size of stop, time of exposure, distance and, for further information, weather conditions.

With the use of an autograph back fitted to your present kodak these records can easily be put down and become a permanent fixture to the negative.

As you gain experience these data will become unnecessary, but I would heartily recommend the writing of each title on the films. How would the township and range number do for location ?

Complete instructions for manipulating this Autograph back are supplied with each kodak as follows:

HOW TO USE THE AUTOGRAPHIC FEATURE

Every negative that is worth making, is worth dating and titling, if for no other reason than for future identification.

The Autographic Kodak has a little door in the back, covering a slot through which the writing is done on the red paper protecting the film. Any medium hard pencil, or the stylus which is provided for the purpose, can be used for writing the titles.

The slot is so located as to bring the title into the margin between the exposures, when the number appears centered in the little red window. This brings the title at the bottom of an upright, or at the left end of a horizontal negative.

When the data has been written on the red paper, and printed (by exposing with door open to the sky, but not the sun, for from one to five seconds) the record is photographically impressed on the film, and appears on the negative when the film strip is developed.

Oftentimes a surveyor wishes to take a view showing some particular point in detail. This particular point might be a pit or mound, but lies in shadow. My advice would be by using a tripod to time-expose for the shadow and let the distance take care of itself. Here is an opportunity to exercise judgment in your focusing; focus for the centre of the group of pits, not the nearest side to the kodak.

Use a little of your artistic ability in the composition of your views. The view finder reflects in miniature a likeness of what is on your film. So take care not to show all foreground and no sky, nor all sky and no foreground. Try to avoid large trees in the centre of the foreground. Swing these to one side showing only the upper branches and if necessary the trunk.

I am now going to show you the results of this deterioration I spoke of earlier in my talk. In this specially constructed box are two tungsten lamps transmitting light through the ground glass. You can see the contrast in these negatives when laid on this glass. The first negative was taken last June with Mr. A. M. Narraway's kodak on a film taken out of the same lot as he took West with him. The second one was exposed somewhere out West, and about six weeks later sent into the office for development: notice its thinness caused by deterioration. The third negative is taken from a roll, brought in by Mr. Narraway about October, exposed here and developed the same day. Negatives one and three are considered perfect as regards printing qualities while number two is valueless.

I am fortunate in having Mr. Narraway's assistance in making this demonstration because I consider Mr. Narraway one of the most successful amateur photographers in the field. This past summer he experienced his first failure in nine years, due to his carrying out the instructions from head office advising him to send in his films for development. Naturally Mr. Narraway will take his developing tank along with him in future.

The film we have just developed is sufficiently fixed for examination, and I think you will all agree with me that the quality in the negative is every bit as good as the film exposed and developed last June.

At the conclusion of the paper questions were called for.

Mr. Wight.—What is your opinion of the exposure calculator and diary ?

Mr. Carruthers.—Any of these exposure meters are all right if instructions are fully carried out. It concentrates one's mind for a time on exposure, and will undoubtedly have its effect in time from the calculations and diary kept.

The Secretary.—What is the weight of that camera ?

Mr. Carruthers.—The weight of a post-card size camera with case and tripod is five pounds; the kodak alone weighs 42 oz. This takes a picture $3\frac{1}{4}$ x $5\frac{1}{2}$. This other camera, the 4A, takes a picture $4\frac{1}{4}$ x $6\frac{1}{2}$, but is considered too bulky to handle without a tripod. Under ordinary conditions it cannot be held steadily enough to insure sharpness of definition. The post-card size of picture, they say, is capable of enlargement to about 14 x 17 with satisfactory results.

Mr. Narraway.—Is the camera supplied by the office adequate for the work called for ?

Mr. Carruthers.—Personally, I do not think it is. The lens of the camera is very good for favourable conditions—full daylight and bright weather—and when handled very carefully by one who understands it. Here is a camera that costs $25. In such a camera the initial cost is the main factor, for the cost of materials is the same as for a cheaper camera. You can pay $100 for a camera that will use the same film as a two-dollar Brownie. And how many good pictures do you get out of a Brownie ? But this present office camera is not good enough for the surveyors. They are capable of handling something better. And if this summer they show a material improvement in their work, I believe the office will favourably consider the buying of a better camera for them. Of course, in saying that I am not speaking officially. The present times are not exactly propitious for the buying of expensive kodaks.

Mr. Rannie.—What is your opinion of the film pack ?

Mr. Carruthers.—The film pack has been discarded lately by many people on account of the cockling of the films, due to atmospheric changes. The same complaint was encountered when Eastman put on the market the Kodoid film, which, in my opinion was an excellent idea for individual exposures. But shortly after the opening of packages these films buckled so that it made sharpness of definition almost impossible. Another reason for discarding these many innovations is the desire to standardize their output, inasmuch as the post-card size seems to be their limit. If one wants to take only one or two pictures and develop immediately, I would advise the plate adapter.

Mr. Rannie.—I understand that the ground glass back is one of the advantages for the firm's big camera.

Mr. Carruthers—Eastman goes one better by providing you with this new patent range finder which eliminates the necessity of focusing by the ground glass.

The President.—I am sure we are all thankful to Mr. Carruthers for his interesting address and for the very valuable pointers he has given us. If we are to take views in the field it is worth while to do it well. I am sure we shall profit by what Mr. Carruthers has told us. I thank Mr. Carruthers on behalf of the Association.

We are to have a discussion of Methods of Survey, and on this general subject there are three papers· The first is on Subdivision Surveys by Mr. Norrish, the second Stadia Surveys by Mr. Cowper, and the third on Transport by Mr. Pierce. I call for Mr. Norrish.

Mr. W. H. Norrish read a paper on Topographical Surveys in connection with Rural Planning from which the following are extracts:

EXTRACTS FROM PAPER ON

TOPOGRAPHICAL SURVEYS IN CONNECTION WITH RURAL PLANNING.

BY W. H. NORRISH, B.Sc., D.L.S., O.L.S.

Most of the members of this Association have, no doubt, followed with considerable interest the various discussions during the past year or two on the question of rural planning and development; and have read some of the many papers proposing schemes for the settlement of the returned soldiers on the land, the formation of community centres, and new ideas on the modification of our present system of rectangular subdivision of Dominion lands so as to create rural villages or the so-called community centres·

We have all been more or less interested in these various proposed modifications of our system of survey so as to form community or rural villages. I think though that most of us have been inclined to smile at the apparent futility of all such schemes which consist merely of a complicated geometrical figure, and do not take into consideration the topography of the ground. I think we are agreed that if there is to be any change, it must be based on topography, and that we do not want another geometrical system, though some of us may feel that these geometrical solutions may help, by giving us suggestions as to methods of planning rural developments. One outstanding point to be noticed in many of the proposed plans of townships is that the lots are triangular in shape and converge on community centres. I fear that the practical farmer will not take kindly to the triangular farm.

The objections to our present system of subdividing are well known to all of us and need no comment. The quarter sections are said to be too broad, so that the settlers are too far apart and suffer from lonesomeness. Then, a quarter section is often split into halves by an unfordable river or lake, a marsh, swamp or other impassable topographic feature. Again there are often quarter sections adjoining each other, neither of which contain sufficient good land to attract a farmer; but, if the two or more good areas could be joined together into one lot, they would make a good farm. One of the greatest objections is to the system of roads. If all the road allowances are opened there are said to be too many roads costing too much for upkeep and that the distance to travel to town is too great by right angled roads. We also know that roads built according to geometry and not topography are anything but efficient.

Too much stress cannot be laid on the importance of good roads, and one of the greatest uses to which a topographical survey could be put would be the planning of more direct and more efficient roads. At present when there are obstructions on the road allowances such that they are absolutely impassable, road diversions are surveyed around the obstruction. The roads are often graded across sloughs at tremendous first cost and very high repair expenses, inasmuch as they often have to be regraded each year. When the sloughs are filled up in the spring these grades, if not absolutely impassable are nearly so, and they are so badly cut up with the traffic that they regularly have to be repaired during the dry weather in the middle of the summer. In the meantime the farmer is able to haul only very small loads over the roads and they are probably impassable for the automobile, which is becoming of greater use to the farmer each year. After being carefully repaired during the summer, the same piece of road may be equally impassable the following spring.

It seems to me that the time has now arrived when a great deal more attention should be paid to topography and soil classification on such subdivision surveys as are carried on. and that topographical surveys should now be undertaken in the older parts of the country with the object of planning all future developments and gaining exact information as to the land which is either vacant or being held out of production.

Our neighbor to the south is not losing time in planning after-the-war developments and the Engineering News-Record of October 11th. 1917, says that Secretary Lane of the Interior Dept. has issued instructions for the classification of 20.000.000 acres of land scattered throughout 15 states.

The Dept. of Lands and Mines of the Province of New Brunswick commenced extensive surveys of forest and agricultural lands during the season of 1916. Their soils were classified carefully according to physical properties and chemical tests of samples were made by agricultural experts.

California has recently undertaken soil classification surveys with the primary object of properly assessing the land. The work has consisted of making soil and topographic surveys and maps to show the boundaries of the different types of soils grading them as 1, 2, or 3 of each type or as unfit for cultivation. All areas in permanent crop such as orchards. vineyards. alfalfa, hops, etc., are shown.

The topography shown consists of streams, dry channels, irrigation or drainage ditches, levees, roads, buildings, fences, brush or timbered areas, etc.

The maps are made by compass and pacing, being plotted in the field or by traverse plane-table. The finished maps on white paper with colored inks show soil acreages, acreages in each permanent crop, acreages in roads, rights of way, etc.

These maps are accompanied by a report on the soils showing for what crops they are best adapted, a comparison of values and the irrigation or drainage possibilities.

The type of soil is considered to be the most important consideration in fixing land values. Some of the previous errors in assessment in California were that the same soil at different points the same distance from the railway was assessed much differently, and that all lands of certain districts were assessed at the same rate even though some soils were worth five times as much as others.

All deeds, recorded surveys, or approximate surveys if obtainable, or the original public land surveys, were plotted on the maps before they were sent out.

The scale used was one inch to five chains and cross section paper was used for plotting. Other details shown were the variety of orchards or vineyards, and whether good, bad, etc., the annual crops such as hay and grain, the cost of clearing brush on timbered lands, the value of buildings, the size of irrigation or drainage ditches, the condition of roads, levees, etc., and the depth of water in wells. The soils are named in accordance with the soil surveys of the United States Dept. of Agriculture. Samples of soil for analysis are taken from representative areas and borings are made. Surface alkali is shown by the presence of weeds and under surface alkali by electrolytic instruments.

The cost of these soil classification surveys in California varied from 3 to 6 cents per acre including office costs· It should be borne in mind that on account of the nature of the country such surveys would probably be considerably more expensive than surveys of a like nature in our western provinces.

It seems eminently desirable that if topographical surveys are undertaken in Canada they should not be of the approximate nature of the compass pacing surveys of California but should be accurate topographical surveys which would serve the purpose of all future planning. Our standard of land surveys has in general been much higher than that of our neighbor to the south; and although our system has been modelled after theirs, it has been carried out with a great deal more accuracy· It is not advisable now to adopt approximate methods in order to affect a small saving in cost and then find in a short time that the work would have to be done over more accurately, costing in the end considerably more than if done properly in the first place.

However, it seems that the California soil surveys suggest the possibility of obtaining a great deal more information from our original subdivision surveys at comparatively low cost by adding topographers to the party charged with the duty of exploring the interior of the sections. If the lines of levels now run could be extended so that the blind lines would also be levelled, the topographer with compass, hand level and pacing would be able to contour fairly well the interior of the sections.

He could first run through the section on the 40 chain or quarter section lines with the compass and pacing, using the hand level to carry elevations. He would leave a mark at each small stream, pond, slough, marsh or muskeg to be traversed and after finishing the quarter section lines he would pace traverse these topographical features. Care should be taken to delineate the dividing line separating one class of soil from another and the soil and timber should be carefully classified.

The topographical map prepared from this information would form an admirable basis upon which to plan the development of the township; and if the topography was such that the ordinary subdivision survey did not seem to be well adapted, another plan of subdivision could be superimposed on it and the additional surveys made before allowing the lands to be thrown open for settlement. The subdivision surveys would have at least served the purpose of obtaining the topography and establishing monuments from which other lot corners could be easily established. Bench marks would have also been established for all future purposes.

It seems, however, that the larger and more important field for our future efforts should be in the country which is near the existing lines of railway and which is only partially settled. Unfortunately thus far our surveys have been mainly restricted to surveys of unpatented or crown lands, but I believe that in future our object should be to secure the denser settlement of the country adjacent to the railways without regard as to whether the lands are patented or unpatented.

I am of the opinion that we should, by a preliminary investigation, determine which areas of the country, within reasonable distances of the railroads, are capable of supporting largely increased populations; and then we should make detailed topographical surveys and plan their development. Since the Dominion Government has charge of our immigration policies and has created a Department of Colonization, it seems to me that this Government is the most interested in the settlement of the land and should undertake such topographical and planning surveys. I do not contend that the Dominion Government should undertake and pay for improvements now paid for by the provinces; but I believe that the Dominion Government should do the planning and should gather extensive information to help the incoming settler choose his land.

There are four main classes of land encountered in making such topographical surveys:

(1) Dominion lands open for homestead entry.

(2) Homesteaded lands not patented.

(3) Patented lands not being cultivated or partially cultivated.

(4) Patented lands not being cultivated, including abandoned farms, lands held by speculators, land companies, railway companies, etc.

In planning the development of the country it will be noted that the first class remains under Government control. Consequently the Federal Government is free to make any plans desired for the disposition of the lands. This constitutes, in my opinion, one of the strongest arguments why the Dominion Government should make such surveys and plan the development, inasmuch as there are considerable areas of these crown lands still unsettled, lying close to the railways. The fourth class of lands above enumerated are also lands over which the government could regain control. That is to say, that if these lands could not be forced into cultivation they could be purchased by the Government and sold again to bona fide settlers. If purchased, it would then be possible to subdivide these lands and those of class one according to any scheme desired for the proper development of the country.

In my opinion detailed topographical surveys in partially settled, fairly open country should be made with the plane table, equipped with the telescopic alidade. Contours should be drawn and should be controlled by adequate level lines carried from the Geodetic Survey bench marks or from the Topographical Surveys Branch precise level bench marks.

It should be borne in mind that plane table surveys are accurate and would be well in keeping with the high class of work done on surveys of Dominion Lands. In general there are two main classes of land surveys. First there are those which have for their purpose the survey of the boundaries of parcels of land and the placing of monuments to mark the corners. The correct astronomical bearing of such lines must be determined with the transit in order that the lines may be properly retraced if part of the monuments are lost. The second class of surveys have for their purpose the making of a correct plan showing topographical features. If such surveys are made with the transit and chain or the transit and stadia, areas which are required or distances to be scaled off the plan are limited in their accuracy by the scale on which the plan is drawn and the consequent degree of accuracy with which it is possible to plot the survey.

Now when a plane table with a telescopic alidade is used and the telescope is equipped with stadia hairs, the distances may be read just as accurately as with the stadia transit. The length of shots which can be read, equal if not exceed those of the stadia transit, for the diaphragm used in the telescopes of the International Boundary Survey plane tables are so graduated that one-eighth or one-quarter of the whole interval may be read to take side shots of topographical features of such a nature that the distance need not be read with great precision. I myself have taken a maximum reading of 4400 feet and checking by triangulation found it to be quite accurate. In brushy country, it is often a great convenience, in reading ground shots to locate contours, to be able to take one-eighth or one-quarter of the interval. This means that the rod may be nearly hidden with branches and yet a reading may be taken sufficiently accurately for a ground shot. The graduations which are etched on a glass diaphragm are so arranged that there is little chance for mistakes. That is to say, it is hard to confuse the eighth with the quarter interval, or the quarter with the half, etc.

The plane table has a great advantage over the office in the matter of plotting directions. In the field the directions are very accurately laid down on the paper for the reason that the objects themselves are sighted on, whereas in the office a protractor is used and, except with the best of plotting machines, it is not possible to plot a direction within about one-quarter of a degree.

The result is that surveys having for their purpose the making of an accurate plan are carried out with great precision by means of the plane table. Even on the large scale of 1/2000, which is about thirty inches to a mile or 2½ chains to an inch, I have found that traverses of a mile or so usually close so well that practically no adjustment can be made. When closing on a point already fixed on the plot, the small error in closure may be immediately spread over the traverse courses and topography of a fixed nature, such as corners of buildings or other masonry structures likewise adjusted.

The plane table is particularly useful for sketching contours. Contours to be accurate must be drawn in the field. If the transit and stadia are used a plotting board should be carried in the field and the work plotted at the same time. The telescopic plane-table alidade is of course equipped with a verticle circle and verticle angle levelling can be done as accurately as with a transit. No difficulty should be experienced in carrying elevations a mile or even two miles and closing within a few tenths of a foot. When the ground is fairly even the striding level on the telescope may be used and the shots read level between the stations. In this way I have levelled a mile with a closure of 0.03 feet.

It is very necessary that proper lines of levels should be run in connection with plane-table topographical surveys. Precise levels are being rapidly extended throughout the Dominion and these should be used as the basis of shorter lines of good secondary levels from which bench marks should be placed at short intervals throughout the district in which topography is to be taken.

It is important that contours should be at once referred to mean sea level. If proper control levels are not run, the result would be that at some future time, the contours would have to be corrected, so as to refer them to mean sea level. As stated above, contours cannot be accurately drawn except in the field; and, if they require to be corrected, the best way is to take the sheet back to the field and redraw the contours referring them to the proper datum.

Practically no transit lines would have to be run to control plane-table surveys in the western provinces, the Dominion lands system of survey furnishing all the control that is necessary. If at a later date it was deemed advisable to publish topographical sheets based on latitude and longtitude, as has been done in nearly all other countries, the same plane-table topographical sheets could be used, connection between the Dominion lands system of survey and a system of geodetic control being made at points sufficiently close together that the plane-table topography could be accurately fitted in. One important feature of the Dominion lands system of survey as a control basis for topographical surveys is that there are no cumulative errors.

In some isolated cases in the older parts of the West, it might be necessary to resurvey or retrace some of the section lines to give adequate control; but, it should be borne in mind, that plane-table traverses can be carried accurately for considerable distances, and that no more ties are necessary than are required of the stadia parties at present working on the surveys for the revision of water areas. It is by no means necessary to be able to find every monument.

It should be noticed that the surveys for the revision of water areas at present being made by stadia parties, could be just as accurately made by plane-table; and that in addition to showing the shore line of only those lakes over five acres in area, the shore line of all ponds or lakes would be shown as well as the boundaries of all worthless land of whatever description or size. Moreover, if sufficient soundings of the lakes were taken and used in conjunction with the contours of the ground, the position of the shore line of any lake would at all times be closely known, if the elevation of the surface of the water were determined.

The point is often raised that the plane-table is useless in the bush. The main objection is the difficulty of carrying it around. It is difficult with any instrument to obtain accurate topography of minor topographical features and ground contours in bush country; but, in country partially covered with bush a plane table party would usually map the open country surrounding the wooded area and would then follow the topographical features through the bush with hand instruments, such as compass and hand level, either chaining or pacing the distances according to the accuracy desired. If there is no good reason for wasting time locating contours through a piece of bush, they might be dotted in, as is sometimes done on the plane-table sheets of the International Boundary.

The task of choosing a scale for topographical surveys is a very important one and requires a great deal of mature consideration before making a decision. There is no doubt that a natural scale is much more convenient to use than one in which an inch represents a certain number of chains, feet or metres. Mr. Douglas H. Nelles, D.L.S., in his paper on "The Mapping of Canadian Cities" read before the Canadian Society of Civil Engineers, makes certain suggestions for the standardization of topographical survey sheets in Canada. His scheme is worthy of careful consideration. He suggests that surveys of cities be made on a scale of 1 to 1000 and that they be published on sheets covering 30 seconds of latitude and 30 seconds of longtitude; and, that rural surveys should be made on a scale of 1 to 10,000 and be published on sheets covering 5 minutes of latitude and 5 minutes of longitude. It will be noticed that 100 of the sheets of the first scale would just cover the same area as one of the second. These standard sheets would be 25½" x 36½". Mr. Nelles works out with some detail a scheme for numbering and indexing these sheets, but I shall not mention those details here.

I am of the opinion that the 1 to 10,000 scale is the one which is best suited to topographical surveys with the object of rural planning and development work; and base this opinion on the purpose which such surveys are to serve and the detail which must be shown on the sheets in order to serve this purpose. On a natural scale of 1 to 10,000, one foot represents 10,000 feet on the ground, one link represents 10,000 links on the ground, or one metre represents 10,000 metres on the ground. That is to say, one of any unit represents 10,000 of the same units on the ground. With three 1 to 10,000 scales, one graduated for links, one for feet, and one for metres, survey measurements made in any of these units could be easily and quickly plotted. This means considerable convenience in revising the sheets from time to time. Location surveys of new roads, railways, drainage or irrigation works could be easily plotted no matter which unit was used for field measurements.

The 1 to 10,000 scale is about 6 1/3 inches to a mile, or one inch equals approximately 12½ chains, a scale slightly smaller than that used for the field plots of stadia surveys. Diagonal scales are usually used for plotting with the plane-table, the distances being quickly and accurately picked off with dividers and plotted.

A great wealth of detail can be shown on a scale of six inches to a mile as is illustrated by one of the topographical sheets of England on this scale which I have here. A very complete set of symbols, such as is used by the United States Coast and Geodetic Survey, should be devised so as to add to the amount of detail which can readily be shown. In addition to all natural topography and contours I think a topographical sheet should show:

(1) Careful soil notes together with the delineation of the boundary of each class of soil. To aid in soil classification, borings should be made and samples of each grade of soil analyzed. The sheet should then be accompanied by a report on the crops

which could be successfully grown on each soil, and a climate report. Surface alkali should be shown and underlying alkali detected by electrolytic instruments and shown.

(2) All areas under cultivation and nature of crops. The additional areas fit for cultivation should be clearly traced from the topography and soil notes.

(3) All fences, buildings, roads, railways and other improvements, together with all survey monuments found.

(4) All areas of bush land with notes as to the probable cost of clearing, if such areas are suitable for agriculture. If not suitable for agriculture and if vacant crown lands, data should be shown which would indicate the possible use such areas could be put to, or, if they would be better held as forest reserves.

(5) The name of the occupant of each parcel of land and the name of the owner. Where parcels of patented land are found vacant particular care should be taken to obtain full information including the probable value of the land and improvements.

This latter information would in my opinion be very valuable in the hands of the Government. If a way could not be found to force the cultivation of the land, the Government might purchase it and sell it over to an incoming settler, or arrange the purchase for him. The Government would be in a position to give the settler trustworthy information and take the deal out of the hands of unscrupulous real estate agents. The province of Nova Scotia appointed a commission in 1912 to purchase vacant lands, improve them and resell them to bona fide settlers. If a policy such as this could be inaugurated the Dominion Government would regain control of the lands and where necessary to properly plan the development of the district the land might be resubdivided.

I think the time has come when the Government of this country can no longer afford to leave the incoming settler entirely to his own resources and his own discretion in the choosing of land. The best of information should be at his disposal and he should have the help of capable and trustworthy Government officials. It should also be noted that the survey I have suggested would show the exact amount of good land in each parcel, the class of soil and the crops it is suitable for. This would be the very best of information to give the banks in order to secure credit for the prospective settler. Care should be taken that land shown to be worthless by the survey should be held as crown lands, and no chance given to a settler to take it up and waste his time and money trying to farm it.

Every endeavour should be made to try to get returned soldiers on the land, but whether or not they will take to farming, a new and progressive land policy ought to be adopted, which should aim to turn the tide of flow of our own population toward the land. Above all Canada must do her best to obtain her fair share of immigrants from the war weary countries of Europe. As indicated above, our neighbor to the south is already carrying out soil classification surveys, and it is not fitting that we should be lagging behind in this respect.

The uses to which a topographical survey as above outlined could be put would be many and varied. Better roads, drainage and irrigation schemes could be laid out on paper and afterwards surveyed on the ground. The system of subdivision as far as it remains under Government control, or in so far as Government control could be secured, might be modified where necessary to provide for the future development and settlement of the land. If deemed advisable, provision could be made for rural villages or community centres.

The contention will probably be made that the Federal Government has no jurisdiction over road building, drainage and irrigation schemes. This is erroneous as the Dominion Government is a party to every such development which affects crown lands, which is the case with all projects of any magnitude. The consent of the Dominion Government is required before such works may be proceeded with. Again, I say, and I think the members of this Association will agree with me, that the Dominion Government is the most interested in immigration and colonization; and, that therefore they should make the surveys and plan developments. My proposal is that plans should be made and not necessarily that the actual developments should be carried out by the Dominion Government.

As the area mapped increases the plans become very useful in planning larger works such as water power developments, additional branch lines of railways, etc. Information would be at hand showing the area of agricultural land to be reached by the railway and it would be easy to figure whether it would pay or not. Lastly these maps would serve all the purposes for which

Militia and Defence maps are being prepared in Ontario and Quebec.

To revert to the details of survey, I believe that the most efficient organization for such would be to have a surveyor in charge of two or three plane-table parties and one level party to run secondary levels through the district to be mapped. An efficient plane-table party consists of a topographer, an assistant and two rod-men. The assistant would record all data in connection with traverse or station readings, so as to check the plotting in case of failure to close, would read the vertical angles and by means of a stadia slide rule compute the elevations and the corrections to the horizontal, where necessary. The rod-men when properly trained would sketch buildings and improvements and gather a lot of information which would save the topographer trips away from the table. My idea in arranging several parties under one surveyor in charge is to allow the chief freedom to gain all the general information possible and to plan future developments on the field sheets and report fully on his proposals. I believe the field is the place to plan and with one competent man planning from the surveys of several parties the cost would be reduced as low as possible. It has been contended that plane-table surveys are complicated, but I have not found them so, and I think one of the principal reasons is that the work is graphical and with the ground laid out in front of you it is difficult to make a mistake which does not show up immediately so that it can be corrected.

In the last analysis, however, the question as to whether topographic surveys should be undertaken or not may be decided from a cost standpoint. It should be demonstrated that they are worth the cost involved and this can only be done by actual work, as there are few surveys in Canada which bear any resemblance to the surveys I have proposed. Narrow strips of topography along the International Boundary have been taken with the plane table and most of it has been done on the scale proposed. On the Ottawa water supply surveys with which I was connected, the proposed pipe line route was mapped with the plane-table on a 1 to 2,000 scale and the engineers supplied with tracings from which the paper location was made, a profile drawn and the estimates made. The drainage area of approximately 150 square miles was mapped on the 1 to 10,000 scale with the contours on the higher timber covered hills drawn from photo-topographical surveys. On the large scale pipe line maps as high as 80 acres was covered in a day showing a great amount of detail. The average was probably about 50 acres. This, however, does not give any information as to the cost in the west as the character of the country was such that it was much harder to map than the west would be, and the scale was so large that much more ground detail could be shown than on the scale I propose, and there were a great many improvements to show. The Canadian Pacific Railway used the plane-table extensively on their irrigation surveys in Alberta. There has recently been some discussion in the Engineering News-Record on the cost of stadia topographical surveys and on page 607 of the issue of September 27th, 1917, a Chicago firm of engineers give the cost of eleven different surveys, ten of which average 14 cents per acre and cover surveys for irrigation, industrial development, sewer design, reservoir sites and coal areas. The localities covered are from the east to the west of the United States, the topography varied from orchards, broken by canals to rough country one-third wooded. The cost of these surveys would be high because they were comparatively small in area and the initial costs would be greater that would be expected, were such surveys carried on from year to year.

I believe that in fairly open rolling country each plane-table party as outlined above would be able to cover nearly a section each working day. After allowing for Sundays and inclement weather I believe the maximum cost would not exceed 10 cents per acre and would perhaps be considerably less. For fall work, to keep the loss of time as low as possible, celluloid sheets could be used.

Lastly, practically all other countries have undertaken general topographical surveys, which seems to indicate that they have been found very necessary. In Great Britain the first topographical map was started in 1747. In 1854 the map of Great Britain on a scale of 1 to 2,500 was commenced. This survey is periodically revised so that no sheet is more than 15 years out of date. This scale is four times as large in lineal scale or sixteen times as large in area as the one I have proposed for Canada. Much greater detail is therefore shown and the cost is much higher than would be the case here.

The President.—Mr. Norrish's paper opens many interesting questions which I hope there will be opportunity to discuss later on.

Mr. G. C. Cowper, being called upon read his paper on Stadia Surveys as follows:

STADIA SURVEYS.

BY G. C. COWPER, D.L.S., A.M. CAN., SOC. C.E.

The system of deducting the areas of small lakes and ponds from the quarter sections was copied from Ontario and Quebec, at the inception of surveys in the west. However, an essential difference, in the nature of the lakes in the West was overlooked.

In Ontario and Quebec, the forest in its natural state, comes right up to the bank of the lake. Generally a beach, more or less uncovered according to the stage of the water, slopes from the bank towards the water. These lakes are permanent bodies of water, deep in the centre, fed by creeks, and with a constant flow of water discharging into streams, or other lakes. Their area is little affected by the level of the water. The owners of properties bordering on these lakes have riparian rights, which are proper and necessary for the full enjoyment of their properties.

In the West, there are very few lakes of this nature. The majority of the water areas formerly shown on the township plans are merely depressions on the ground, which fill with the melting snow in the spring, and have no outlet. The water disappears by percolation and evaporation, and at the end of the summer has either entirely disappeared, or else is concentrated in the lowest part of the depression.

These water areas vary greatly during the different seasons, and also during the wet and dry cycles which are common in the west. In dry years they practically all disappear, and in wet years may remain at high water mark during the whole summer.

Surface water has been defined as water on the surface of the ground, the source of which is so temporary or limited as not to be able to maintain for any considerable time a stream or body of water having a well defined and substantial existence.

The majority of the water areas in the West fulfil this condition, and to these it is unlikely that riparian rights can be attached.

Previous to 1883, the survey contractors were permitted to traverse all water areas, without any regard to their shallowness or permanency. So it is safe to assume from this, that all surface water was traversed, where it could be done so at a profit.

From 1883 to 1912, surveyors were instructed to traverse all water areas which did not dry up, the permanency of the water areas being determined as to whether or not they could be forded.

The line to be traversed was the bank, and this was held to be the line where vegetation ceased, or where the character of the vegetation and soil changed.

The areas of the fractional quarter sections were calculated to the banks, and these areas were the ones granted in the patents.

It is apparent then, that with the areas of the lakes continually changing, a traverse made in the spring would show a much larger area of water than one made in the fall.

In addition to this seasonal change, a marked decrease in the total amount of water is apparent from year to year.

This drying up of the water areas has been going on for the past thirty years, and is partly due to settlement and the cultivation of the soil, and to the deepening and clearing of the stream channels, and the gradual increase in farm drains.

It is most marked on traverses of larger lakes made at periods of twenty to thirty years apart. Invariably the later traverse will show more land.

This condition has naturally led to the settlers applying for additional patents as the lakes have dried up. The question arose as to whether the government or the settler, due to riparian rights, owned the dried up beds of lakes. Opinions differ as to this, the Department of Justice holding that the settler owned the bed, and that the government could not issue a patent for what it did not own. The Registrars in the West will not issue certificates of titles for dried up beds of lakes without a deed from the Government. To overcome this the Government issues "Quit Claim Deeds" for these dried up beds.

It was decided in 1912 to patent all fractional quarter-sections bordering on bodies of water which did not have a permanent, well-defined bank, by those legal subdivisions and quarters of legal subdivisions which most nearly covered the land not rendered worthless by water.

This has put an end to a settler purchasing a fractional quarter section shown on the township plan as containing only a few acres, and acquiring by riparian rights, lands which were not paid for and to which they have no equitable rights. These lands in many cases are among the most valuable in the country.

By the provisions of the Irrigation Act passed in 1898, no grant shall be made by the Crown of any exclusive property or right in the land, forming the bed or shore of any lake, river, stream, or other body of water.

This Act applies to Alberta, Saskatchewan, that portion of Manitoba incorporated within the Province in 1912, and the Northwest Territories, with the exception of the provisional districts of McKenzie, Franklin and Ungava.

It would appear from this Act, that all water areas should be deducted from the quarter sections, but I can find no record where the Irrigation Branch has claimed the right to the beds of water areas, which periodically dry up, although the case may arise where they might claim the use of a dried up bed of a lake to use as a reservoir.

On account of the continual drying up of the lakes and the changes in the banks of the rivers, frequent requests were made to the Government for the resurvey of water areas.

These became so numerous that it was decided in 1913 to revise all the water areas in the West. For this purpose stadia surveys were inaugurated. The water areas to be traversed are given in the manual of surveys as follows:

1. Rivers averaging one chain or more in width.

2. All islands and all bodies of water which do not dry up and which are over five acres in area. In case of doubt as to whether a lake dries up or whether the extent is over five acres, the traverse is made.

3. Alkaline mud flats which do not bear the weight of a man walking on them are treated as water areas.

4. Lakes and ponds under five acres are reported in the field notes.

5. A marsh producing hay is not traversed and no deduction is made for its area.

The water areas most commonly encountered on the prairie, with the exception of rivers, belong to one of the following classes :

a. Permanent lakes which have sandy bottom, gravelly beaches and shore lines well defined.. These lakes may be either spring fed or have creeks running into them. The banks are usually quite steep so that a variation of a few feet in depth has practically no effect on the area.

Unfortunately both for the settler and the surveyor, there are very few lakes of this class on the prairie, although they are quite common farther north. A surveyor encountering lakes of this kind is not in doubt as to whether they should be traversed or not. and if numerous enough his mileage for the season will be good.

b. Shallow sloughs with well defined banks from 5 feet to 20 feet high with beds of soft alkaline mud. These water areas usually dry up every dry year, but the beds very seldom get hard enough to walk on and very rarely produce any vegetation. These sloughs are very common in southern Saskatchewan and Alberta. The surveyor is instructed to traverse them.

c. Permanent water areas fairly deep in the centre, but with an indefinite shore line, which vary with the amount of water in depressions. A difference of a foot or two in elevation of water may cause a variation of ten chains in shore line. Along the shore it is usually marshy.

These lakes are traversed and the legal subdivisions and quarters of legal subdivisions which are rendered worthless by water are selected.

This class of lake causes the surveyor much trouble in making a satisfactory traverse as it has no definite shore line and the edge of the water is the only line which can be readily followed. This is especially true in a wet season. as it is only by taking careful soundings and obtaining reliable information from the settlers, that the legal subdivisisons can be wisely selected.

d. Shallow sloughs whose bottoms are either gumbo, hard alkaline mud, or sand. They have usually fairly well-defined banks. They fill from surface water. and usually dry up in the fall, but always hold water in the spring and after heavy rains. In the case of a heavy snowfall in a season, they will hold water the year round. The beds of these sloughs when dry produce no vegetation of any value, and if gumbo, become very hard and full of cracks.

As water areas, these do not qualify as lakes but for agricultural purposes they are practically worthless. Whether these should or should not be traversed, depends, in my opinion, on whether they usually hold water or are dry, for the greater part of the year. Each separate lake has to be considered on its own merits.

e. The final class of water areas met with are shallow depressions, depending wholly upon surface water for their existence. They have no shore lines, the area covered by water depending altogether on the amount of surface water. In dry years they produce hay, and after several wet years may have from eight to ten feet of water. These sloughs in a dry year would not be noticed as a water area. In wet years, however, they have every appearance of being fairly permanent, and it is only from information received from the settlers, that their true nature can be determined.

There are a large number of these areas, which previous to 1915, were valuable hay meadows; that fall they filled with water and have had water in them ever since. These sloughs will undoubtedly dry again and many of them could easily be drained so that they would always be available as hay meadows. The traverse of these sloughs might be of value for topographical purposes. It would, however, be a mistake to deduct areas for them as the first time they became dry the owners would apply for titles to them.

I would estimate that at least 80% of the water areas in the West belong to one of the last three classes. Or in other words, if all the water areas on the prairie were traversed after a series of wet years and again traversed after a series of dry years, 80% of these water areas would either show a much smaller area or would disappear altogether.

The area of a quarter section made fractional by one of these water areas, if calculated to the water line, which is the only line that can be readily traversed, would only be correct for the date of the traverse. It is very unlikely that the area of the quarter section when patented would be the same as shown on the township plan.

The nature of the water areas in the West was fully understood by the Surveyor General and his staff. When it was decided in 1913 to revise the water areas, the following classification for the disposal of the lakes was decided on as being most likely to cover all cases met with.

Class 1.—Lakes that have entirely dried up. The shore line of the lake according to last traverse is shown on the township plan by broken line and called "Former bed of Lake No.— now dry land."

Class 2.—Shallow lakes likely to dry up. The shore lines of lakes are shown on township plan by broken lines, and are called "Low land liable to flooding." No area is deducted for these lakes.

Class 3.—Lakes which do not dry up but which have shore lines subject to large variations, say 10 to 20 chains. These lakes are usually fairly deep in the centre and surrounded by shallow water which is likely to dry up. They are shown on the township plans by aliquot parts of sections for the centre, the shallow water being called "Low land liable to flooding." Careful soundings are taken to determine what aliquot parts are worthless.

Class 4.—Lakes which do not dry up but whose shore lines are subject to moderate variations, say five to ten chains. These lakes are shown by aliquot parts on the township plans.

A lake classified as Class 4 in a dry year might be Class 3 in a wet year.

Class 5.—Lakes whose shore lines do not change. Their shores are shown in full lines on township plans and the areas are taken to the banks.

The Surveyor classifies the water areas at time of survey. If the classification does not agree with the report on lakes, it is changed in the office.

The surveys for the revision of water areas have now been carried on for the last five years. During this period we have had two extremes in the amount of surface water. The year 1914 was the climax of a series of dry years, and in that year there was hardly a drop of surface water left on the prairie. The following year the sloughs began to fill again, and owing to abnormally heavy falls of snow during the past two winters, there was more surface water in the spring of 1917 than at any other time during the past twenty years.

We have here then an opportunity to see if the above classifications will cover the water areas in a township investigated in both a dry and wet year, and yet give practically the same results.

The permanent lakes whose shores do not vary, and also the alkaline beds with well defined banks will cover practically the same area in both a wet and dry year.

The gumbo flats with fairly well defined banks will likely be a little larger in a wet year than in a dry year. If one of these was shown on the township plan of the original survey as a lake and investigated in 1914, it would be reported as dry land; if investigated in 1917, more significance would likely be placed on the worthlessness of the bed when dry, and it would still be called a lake. If not shown on the township plan, no note would be made of it in 1914, but it is most likely a traverse would be made in 1917, and the water area classified as low land liable to flooding.

A traverse of a permanent lake with a variable shore line made in 1914, would contain only those aliquot parts which are worthless. The same lake would be much larger in 1917, and a traverse made then, would contain a number of aliquot parts which should not be deducted from the area. However, if careful soundings are taken and reliable information obtained from the settlers, the worthless aliquot parts may be selected, the remainder of the lake being called low land liable to flooding. If both traverses have been carefully made, the aliquot parts considered worthless should closely agree.

The hay sloughs depending on surface water, would not be considered as water areas in 1914, and if traversed in 1917, would, if their nature could be ascertained, undoubtedly be shown as low land liable to flooding.

So that if the same township was investigated during a dry cycle and again investigated during a wet cycle, the area shown on the township plans as being worthless, with the exception of shallow lakes previously traversed, should be practically the same. There would, however, be a number of low-land-liable-to-flooding areas shown on the plan of the township compiled from the investigation made in the wet years.

This close agreement can only be obtained, if reliable information can be had from the settlers and I regret to say that I know of no other subject on which the western settlers disagree so much, as on the true character of these water areas.

As pointed out, the condition of the water areas in the West depends almost wholly on the winter snowfall and the amount of evaporation the next season. As these move in cycles there are a large number of water areas which are alternately flooded land and dry land. Some of these beds produce hay when dry.

while others are worthless. It would appear that if the water in the hay sloughs was drained into the worthless beds, considerable land of value would be reclaimed and a number of permanent lakes formed. Much valuable information as to the feasibility of these schemes could be very cheaply obtained by having a leveller attached to a stadia party.

I might add that frequent requests are made to stadia parties for information as to the drainage of these lakes.

The nature and extent of the water areas is continually changing as are also the banks of the rivers, so that it is unlikely that the township plans made now will show the true area of the fractional quarter sections five, ten, or twenty years after the survey.

The settler receiving a patent for a fractional quarter section from the government should receive patent for all the land in the quarter section at that date.

The only positive way of doing this would be to have the water areas surveyed at the time of granting the patent. This could very easily be done if Dominion Land Surveyors were appointed as Homestead Inspectors at each Land Office. The survey of the quarter section could then be made at the time of inspecting the improvements at no additional cost.

During a succession of wet years the settlers want deductions made from the areas of their quarters on account of water. During a succession of dry years they want additions made to the areas. The one for reduction of taxes and amount due on their pre-emptions and the other so as to have more land to sell. As these cycles occur periodically, it is quite possible that a lake might be shown on the township plan at the time of original traverse, to disappear with the second investigation, only to appear again during the third or wet cycle. If investigated during the next dry year, it would again appear as dry land.

To guard against this seeming discrepancy in our surveys, no body of water not previously traversed should be shown as water unless it has been continuously flooded for at least five years, or unless it is apparent that the bed is worthless.

No lake should be shown as dry land unless it has been dry for at least five years. A case might arise of a boundary lake investigated in one township during a dry year and called Class 1, and investigated in the adjacent township in a wet year and called water. The township plans would then show the same feature as dry land in one township and as water in the other township.

The President.—I am sure we have all highly appreciated Mr. Cowper's paper. It is certainly remarkable what changes have taken place in the topography. I have seen cart tracks which run into a lake now ten feet deep and come out at the other side, showing that at one time it was all dry.

Mr. J. W. Pierce was then called upon and gave his paper on Transport as follows:

MAN-PACKING.

BY J. W. PIERCE, D.L.S., O.L.S.

In presenting a paper under the above title I realize that I am treading on dangerous ground; man-packing is not usually considered one of the most pleasant duties of survey work, in fact, I believe that to many who have had the experience of a season or two on surveys where the tump-line formed part of the equipment, it is a question whether the recollection of the hours spent in the intimacy of a pack is not as tenderly recalled as that of the numerous encounters with the mosquitoes or of any of the other various forms of energetic occupation that go to make up the routine of survey camp life.

In contrast with surveyors of the Provinces of Ontario and Quebec, we have been singularly fortunate in the past in being able to carry out our extensive surveys in the Western Provinces without having to avail ourselves of this method of transport. In the prairies and through a great portion of the lightly wooded country to the north, horses and waggons have fully met the requirements, while in the more densely wooded districts which are lately being surveyed, the pack horse is found to stand pre-eminent over all other methods of transport, and it is not to be presumed for a minute that there is any other method of transport that can be successfully or economically conducted in country that is suited to the use of horses. There are cases, however, where this method of transport is not found to be the most suitable or convenient, a few of which may be cited:

Surveys, where it is possible for the party to reach central points in the work by means of rail or water at no great distance from the extremities of the work, and where supplies would naturally be landed at such central points by other means than pack-horses, thus necessitating in the event of using horses during the survey, special arrangements for the transportation of idle horses to and from the work.

Surveys in districts unsuitable for the use of horses on account of lack of feed, extensive muskegs and mountains,, or that present undue difficulty in construction of pack-trails.

Isolated or outlying surveys of small extent where the cost of construction of a pack-trail would bear too great a ratio to the amount of work to be done. Work done by means of "fly camps" would come under this head, and perhaps it may be advisable to further illustrate this by reference to a case met with in nearly every subdivision survey, that where the subdivision is being made on one side of the correction line and it is necessary to bring down a control meridian from the base line through country not being subdivided. Fortunately this does not now present the problem that it did before the introduction of control meridians and chords, when it was necessary, in the case of the subdivision of a township adjacent to the correction line, to survey two boundaries from the base line and connect them by a trial and final line before commencing subdivision. As this most important part of the work frequently occurred at the commencement of a season's operations and necessitated the division of a new and often inexperienced staff and party, the results were not always satisfactory.

From the foregoing it is evident, however much it may be regretted, that surveyors having occasion to work under these conditions are well advised if they, at the time of organization, give consideration to the selection of proper help and to the providing of the simple equipment necessary for what is termed "man-packing."

A description of the essential requirements for this class of work may now be in place. It is advisable to engage a few men as members of the party who have had experience as pack-men, so that when packing is started, they may be able to show the new members what is required both by instruction and example. This is without doubt the key note of the whole undertaking. Men who have never seen this work carried on are usually dubious as to their own personal success when only verbally instructed, a condition of mind that is not always dispelled after their first endeavour in this direction, whereas with the additional encouragement of the example of the experienced members, it is not long before they find that they too can do their share.

Experienced man-packers are seldom procurable at the various organization points generally used by surveyors, and it has been found advisable in some cases to import a few men from Ontario or Quebec, where this form of employment is common.

Tump Lines, Pack Sacks and Pack Sheets, and reflectors are the only additional equipment necessary. The pack sheet is used with the tump line in making up a pack convenient for carrying and takes the place of the blanket, which used to be in common use. It consists simply of a piece of canvas or drill about seven feet long and three feet wide, the sides of which are folded over about six inches and sewn up. The strap ends of the tump line are passed through these folds and the sheet is in readiness for use. In preparing a pack the sheet is laid out flat and the articles to be carried are packed on the centre of the sheet as compactly as possible. The ends of the sheet are now brought together, the straps drawn tight and tied. A few practical demonstrations and some practice is necessary before a properly balanced pack is made, and this is most essential for comfortable packing. Nothing is more irksome or fatiguing than attempting to carry a badly packed or improperly balanced load. An improvement over the old type of tump lines might be described here. This consists of having a buckle sewn to each end of the headstrap and holes punched for twelve or eighteen inches on each of the straps, so that if after the pack is made up, the head strap is too short or long, it may be adjusted by the buckles. In the ordinary type of tump line the straps are sewn to the ends of the head-strap, and when any adjustment is required in the length of head-strap, it is usually necessary to remake the pack.

In selecting tump lines it is wise to have the head-straps at least two and one-half inches wide and to make sure that the material used in their construction is of good quality. If spongy, soft leather is used, the head-strap soon stretches and becomes too narrow for use.

Pack sacks are really a substitute for the tump line and pack sheet. As they are equipped with shoulder straps in addition to the head-strap, they are usually favoured by the amateur, but there is no doubt that when it is necessary to carry a light pack straight ahead for a day or so, the shoulder-straps are an improvement.

When assembling the outfit, it is advisable to have no one piece over one hundred pounds and to use strong water-proof sacks to cover all of the outfit that may be damaged by water or perspiration.. Each piece should be numbered in a conspicuous place and three or four lists made, somewhat after the following:

Numbers 1—50—Flour;

Numbers 51—65—Sugar;

Numbers 66—100–Bacon, etc., until every article is included in the list. The Chief, the Cook and Head Packer have one of these lists and are thus always able to ascertain the quantity of any line of provisions in store without having to open bags to see what they contain.

For summer surveys, in districts where fuel is plentiful, the cook stove, as commonly used on pack horse outfits, is replaced by reflectors. Western survey cooks are at first somewhat inclined to look askance at the reflector, but there are few cooks, who after having had a season with reflectors, would prefer the stove, except in bad weather. A reflector weighs possibly ten pounds and folds up flat, so that it can be slipped into a bag. Bread, cakes, pies and any form of pastry or meat or any cooking or baking required can be performed by the use of the reflector just as successfully as by a stove. For an average subdivision party of twenty-four men, four reflectors are used; this means that four pans of bread may be baked simultaneously which is somewhat ahead of the capacity of a cook-stove.

Reflectors are commonly stocked in hardware stores and sportsman's outfitters in the east, but are not generally procurable in the West. I have been using a pattern that folds fourteen inches by twenty-two inches and is somewhat more compact than those on the market, and find no trouble in having them made by a tinsmith.

Considerable speculation has been indulged in with regard to size of a man's pack and the distance he should be expected to carry it. Outside of survey work packing is ordinarily employed on portages on canoe routes. In the early days through the West much of the transportation was by means of water with York boats and many of the older inhabitants there have engaged in it. In work such as that, there are good trails over the portages and a great many of the portages are short. Where they are long, it is not usual to attempt to carry a load more than thirty chains at a stage or lift, and the procedure is to carry everything up to the first station before anything is taken to the second. Under these conditions, it was not uncommon for packmen to habitually carry as much as two hundred pounds, and I have seen all the Indian members of a survey party load up with three hundred each for a few trips over the last stage of a portage one Saturday afternoon in order to finish early.

On subdivision surveys conditions are altogether different to packing over portages, the line or a blaze through the bush is usually the trail, and seventy-five per cent. of the moves are under four miles. In this every person has his load to carry, which seldom is over one hundred pounds, and after a little experience, the average party will make up their packs and carry them three miles in two hours. A couple of men may then be left to fix up camp, and the main party proceed on the line with a very slight interruption in their work. Occasionally, when moving from one part of the work to another, longer moves are necessary, and when a move above four miles is made, the rate per hour will seldom exceed one mile.

With a new party, while it has been carefully explained to each man at the time of his engagement what was expected from him, care must be taken not to overtax them at the start, and it is not alarming if the results of the first few moves are not very satisfactory. In that case, the first few days' work on line seldom bears any relation to what is accomplished later on.

The fundamental principle in the successful operation of survey work is to treat all the members of the party considerately and fairly, to provide them with the best possible in the way of provision and accommodation, to show them, both by example and instruction, just what is required of them, and in return for this, to let them know that their best is expected from them.

The President.—I am sure this has been a very interesting paper. The hints that Mr. Pierce has given are especially useful

Mr. J. M. Côté was called upon to demonstrate and explain an appliance of his own devising to insure correctness of location and proper size of pits and mound erected at section and quarter-section corners.

The meeting then adjourned until 8 o'clock.

FIRST DAY,—EVENING SESSION.

At 8 p.m. the meeting resumed and the President at once called upon the speaker of the evening..

Mr. H. L. Seymour read a paper on Colonization and Settlement Schemes The paper was in part as follows:

"COLONIZATION AND SETTLEMENT SCHEMES."

BY H. L. SEYMOUR, D.L.S., A.M. CAN. SOC. C.E

MR. CHAIRMAN,
LADIES AND GENTLEMEN,—

One of the great problems of to-day and to-morrow is the developing of our but partly occupied territory having due regard to the incorporating again into our society the men now returning or soon to return from the war.

The first work to be done is that of surveying. But if the surveyor shall do no more in the future than he has done in the past, if he content himself with merely measuring a plot for another to occupy, our success in the future will be no greater than it has been hitherto.

The work of surveying is a matter not of mathematics merely but of public policy.

To show what can be done let me ask you to judge by what has been done. This takes us into history. Colonization plans, and soldier settlement schemes are by no means new.

In 1608 the first real settlement on the St. Lawrence was made when Quebec was founded by Champlain. Some of us were fortunate enough to participate in the celebration of the 300th anniversary of the founding of that city—a very pleasant way of learning history.

According to the Deputy Minister of Lands and Forests, Quebec:—"The system of survey in vogue under the French regime consisted of grants of land varying in width from one, two and three leagues, on a depth of two or three leagues. The grantees or the Seigniors then had these grants subdivided into ranges or farming lots, fields, varying from one to three arpents in width (200 to 600 feet) by a depth of from one to two miles. As the greater number of these Seigniories were granted along the shores of the St. Lawrence the outlines of same were established on the bearing N.W. and S.E., probably to have the front of these Seigniories at right angles with the general course of the river."

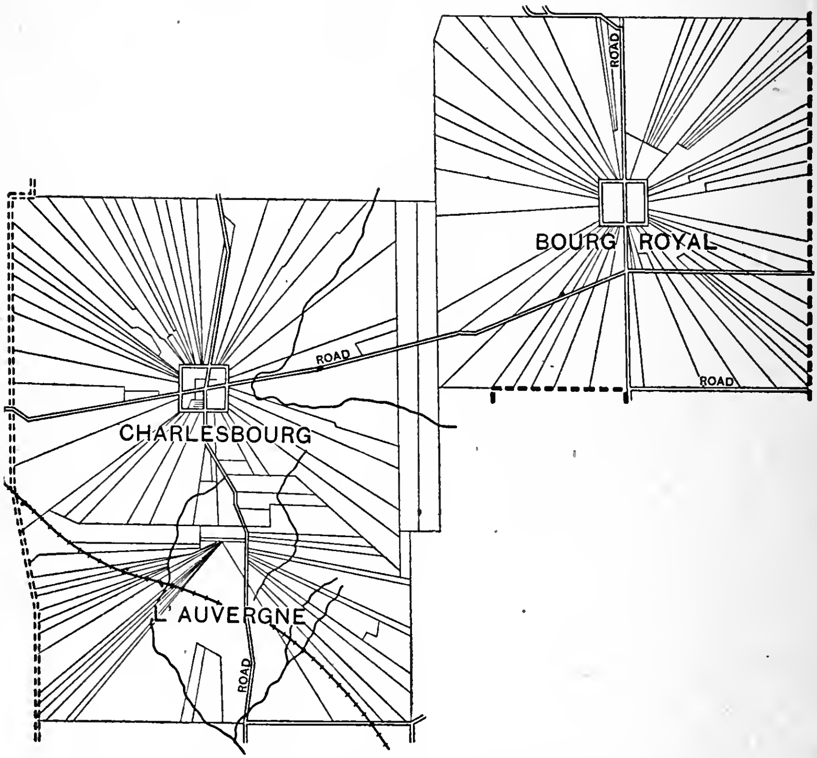
In 1663 New France was made a Royal Province. The French King, now more directly interested in settlement, decreed through his Intendant, Talon, who was in sympathy with his plans of development, that the population be henceforth grouped in centres, market towns and villages. This was not merely an imitation of settlement in Old France, but also because of the ever present possibility of a renewal of hostilities with the Indians. Prudence suggested concentration of settlement. Up to this time in most settlements the houses were usually lined out along the banks of rivers, though frequently not more than two arpents (about 400 feet) apart. Even with this arrangement the distance between the houses of the first and last of say 40 settlers would be about three miles, a long line to defend in case of attack. But the early settlers were not as apprehensive of the Indians as that, under the new decree, they might lose the benefit of labour already applied to their holdings. They were assured that the measure was not retroactive though Intendant Talon proceeded to show them that the scheme was really feasible.

In about 1666, three villages near Quebec were laid out in territory ceded by the Jesuits for that purpose, Bourg Royal, Charlesbourg and L'Auvergne. The farms were triangular with base of four arpents and perpendicular height of about twenty arpents, making an area of somewhat less than forty acres. At a short distance from the vertices of these triangles a square was laid out around which a road was made..

In 1667, the three villages were populated, two with civilians and one with soldiers—(possibly the first soldier settlement scheme). In Charlesbourg we are told that a church was erected at the centre of the square, to which commune all the settlers had rights in common. Houses were erected along the road, some inside and some outside of the central square.

This is an early Canadian example of radial planning. The objects of such planning in this case were primarily for protection and secondarily no doubt for social and communal advantages, of which we hear so much and which have become the primary reasons for such planning.

There were objections then as now to such a layout. The historian Salone in "Le Colonization de la Nouvelle France" claims that the "pro-town planners," the king and his intendant were mistaken, not having taken into consideration all the circumstances. What was possible for the area planned by Talon at a few hours from the chief town of the colony—Quebec—could not be generally followed in a new country where it was



almost indispensable for a settler to have direct and immediate access to a river. To live he had to fish. To traverse the virgin forest he had no other roads than those moving paths, the streams. The popular verdict seems to have been against planning such as Talon favored. A glance at the map of Quebec will show that no other areas were laid out in a similar manner to Bourg Royal, Charlesbourg and L'Auvergne.

Lovell's Gazetteer gives the modern town of Charlebourg a population of about 2500 and states that this favorite resort of Quebecers in the summer months was "one of the model towns of early French Canada."

In 1763 when the people of New France passed by treaty to Britain there were only about 50,000 French left in "Canada." It has been claimed that up to 25% of the French population left after Wolfe took Quebec. With the 13,000 whites in Nova Scotia and say 2000 more in the Island of St. John, now Prince Edward Island, there were (not counting Indians) in what is now Canada less than three-quarters of Ottawa's present population. The settlement of Canada since 1763 will be briefly traced by provinces as now existing commencing with Prince Edward Island:—

In 1764 the Island was laid out into townships or lots numbering 67.. The survey was made by compass, the lot boundaries being arranged north and south magnetically.

N·15½° W., the bearing of the original lot boundaries in Prince Edward Island is now considered the cardinal point for all surveys in the Island where land lines are still run with the compass—the only place in Canada, I believe, where land lines are now run magnetically. From this fact the degree of precision of the surveys in Prince Edward Island can be readily imagined. But in 1764 they represented a great advance on the surveys generally undertaken for some time in other parts of Canada and the whole island was systematically laid out.

If Prince Edward Island were to change its name again it would probably be to "The Garden of Canada," as it is frequently termed. It is the most densely populated province in Canada, forty-four persons per square mile at the last census. No part of Prince Edward Island is more than ten miles from a railway and three-quarters of its area is within five miles of the rails.

There are in the Province, however, considerable tracts of vacant, uncultivated "lands, some of which are capable of cultivation" and agricultural improvements. Realizing that upon the Province it is incumbent to make all reasonable provision for soldiers returning from the war there was passed by the Legislature in 1917 "An Act for Promoting the Settlement of the Unused Lands and the Development of other Resources of this Province." The act provides for the expropriation of privately owned lands, but as yet no lands have been set aside for the purposes of the act.

Nova Scotia—

Dr. Fernow estimates that 80% of Nova Scotia, where not barren, is forest country and practically destined to remain so. As far as I have been able to find out there are no Crown lands in this Province available for free grant: farms or lands must be purchased. The Nova Scotia Land Settlement Act now on the Statute books for a few years, provides that to any person coming into the province and wishing to purchase a farm, 80% of the purchase price is advanced by the Government through a loan company. Though not specially passed for returned soldiers this legislation is of course available for them in this province.

New Brunswick—

Under the French but comparatively little settlement was made in what is now New Brunswick, and probably very little subsequently until the advent of the United Empire Loyalists and soldiers, to whom, as explained, grants of lands and money were made. Subsequently settlers, as a rule, bought their lands at auction at an upset price of 5c per acre, in addition to which there was a fee of 5c per acre for survey.

As to some results of settlement I will quote you from a New Brunswick Hand-Book published in 1857:

"Many of the settlers, who at the outset were in actual want, are now possessed of large and valuable farms, while some have become positively wealthy. These persons were assisted in the first instance, by being employed to make roads through the wilderness to their several settlements, for which they were paid at a reasonable rate. This mode of assistance gave them not only profitable employment, but enabled them to reach their lands with facility. The experiment was attended with complete success and no doubt might be extended to other parts of the province with the like favourable results."

Since Confederation it has been possible to get a free grant of 100 acres from the New Brunswick Government under conditions somewhat similar to those governing homestead entries in the Western provinces, that is as far as the homesteader himself is concerned. But the Government in New Brunswick has recently assumed certain responsibilities which should be greatly to the advantage of the "green" settler. "The only Crown Lands in the Province open for settlement purposes are those contained within certain settlement tracts laid out at the instance of the government and to which there is good access by roads already constructed. Of these lands only those portions which are known to contain at least 50 per cent. of good agricultural land will be open for application." As to surveys the method now is to lay off a tract from 1000 to 10,000 acres in size. When the tract is surveyed and roads laid out, applications are received, an applicant's land being referred to by lot number and range. In case the land has not been surveyed to the satisfaction of the Department of Lands and Mines, a survey is ordered from the Department, to be paid for by the applicant, the fee being $5.00. Just what the surveyor does for all that money I am not informed !

The average population in New Brunswick is about 13 per square mile; with the exception of Prince Edward Island and Nova Scotia it is the most densely settled province of the Dominion. Yet according to the 1911 Census only a quarter of the province was taken up by farmers—(average farm, 126 acres)—and more than 2/3 of the total area occupied was still unimproved.

An act passed in New Brunswick in 1912 created a Farm Board, which is authorized to purchase abandoned farms, improve them and erect buildings thereon, afterwards selling them to bona fide settlers.

In this province a survey of Crown Lands for the purpose of classification was inaugurated in 1916. The object of the survey was to estimate the amount of timber on the land and to delineate the land suitable for agricultural development. In contrast to this commendable procedure it may be said that in the laying out of Dominion Crown Lands in the western provinces no proper classification of lands has yet been attempted although recently the surveyor has been given an opportunity to exercise a certain amount of discretion as to the lands to be surveyed. In the west the settler himself has been presumed, to be the best judge of land. If the settler does not like a certain quarter-section he need not take it: if he does, and his holding proves worthless to him, that is his own concern. This to all practical intents, has been the attitude of the Dominion Government. Though the logic may be unimpeachable, there has not resulted, I believe, entire success in all cases, either to the individual or to the state.

The only effective legislation passed in New Brunswick that relates to the settlement of returned soldiers is the "Act to provide for the granting of land to certain persons who are serving his Majesty in the present war" enacted on the 7th April, 1916, in New Brunswick. The effect of this act is to relieve a settler, who has enlisted and been disabled, of homestead duties.

In 1916 the New Brunswick Government worked out a plan by which Crown Lands were to be given to soldiers free in sections of from 10 to 100 acres under what was termed "The group System of Farms for Returned Soldiers." In other cases where the returned soldiers might wish to purchase land from private individuals the Government were arranging to buy it and sell it to the soldier at the actual cost price, making him an advance on it, he paying 5% down and the balance to be payable in nineteen years. Legislation to this effect was passed, I understand, but has not yet been made effective by the new Government recently returned at the polls.

Quebec—

In 1774, according to the first British constitution, all French laws affecting the tenure of real estate, were to be re-established, that is public lands were to be granted in fiefs and seigniories as prior to 1760. But as a matter of fact in 1783 the Settlement of Canada began under the tenure of free and common soccage, the method of tenure under which lands are now generally granted and held in this country.

The surveys at this time might be regarded as an endeavour to apportion in an equitable manner the claims of settlers already on the land — settlement preceded survey. To soldiers and American loyalists grants were made on the bay of Chaleurs in Gaspe and along the banks of the St. Lawrence and the great lakes in Upper Canada. Under the conditions then obtaining it was evidently almost impossible for surveys to be made regularly although it was intended to have townships six miles square as in the United States.

Only the front lots or lots bordering on a river and required for immediate use by settlers were laid out. Further rows of lots or "concessions" were added as settlement, forced further back from the river, required. Thus naturally evolved what is known in Ontario as the single front system. Townships surveyed under this system were not necessarily of uniform size or shape and frequently changes in the widths, depths and area of lots (from

120 to 200 acres) were made, though roads were generally to be 40 feet wide.

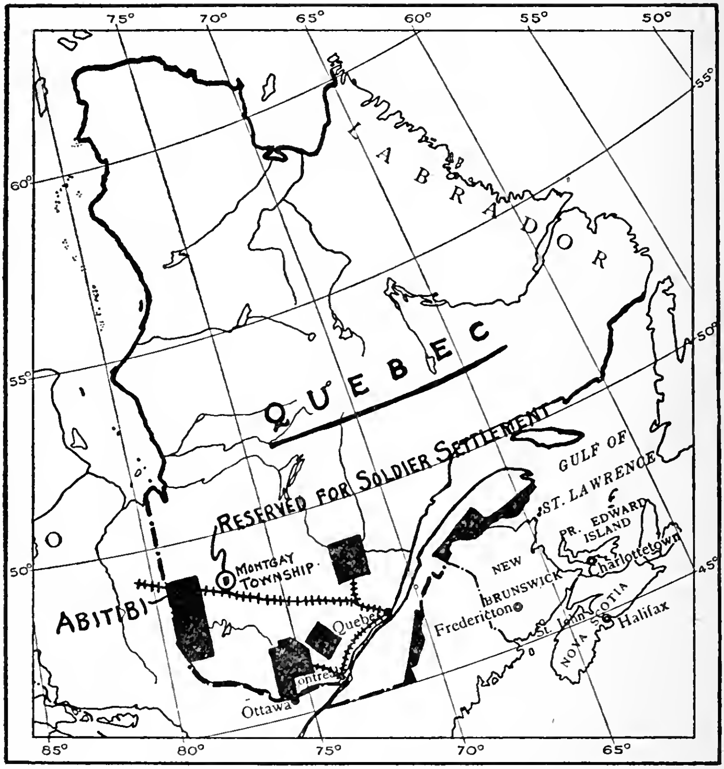
The first Surveyor-General to be appointed was John Collins in 1785. An Act of 1791 which divided Canada into two provinces, had the effect of practically abolishing the system of land grants according to the seignorial method. But it introduced into the province of Quebec, at least, all the evils which the British Government had earlier sought to avoid, and gave rise to the plague of large land holders which it is claimed greatly hindered, for a time, the settlement and material advancement of the province.

The general statement may be made that under English domination the township system has as a rule been followed in Quebec, the endeavour being to locate each township and range in such a way as to give to the lots the largest acreage of farming land possible. "The widths of the lots were originally made from 28 to 30 chains (80 chains to a mile) and the depth (of about one mile) varied in order to give to each regular lot a net area of 200 acres."

About sixty years ago the system was modified and the width of the regular lots in each township became 13 chains by a depth of 80.80 chains thereby still maintaining a net area of 100 acres for each lot, exclusive of the 5% reserve for highways.

From Lake Abitibi eastward a strip of territory in the vicinity of the Transcontinental Railway has been surveyed into townships 10 miles square, which are definitely correlated by the system of survey though still—as in the case of older townships—designated by unrelated names. Mr. J. E. Chalifour, Chief Geographer of the Dept. of the Interior, finds in the present system of narrow long lots but a continuation of the early system of settlement with families grouped closely together along the main roads. Such an arrangement was essential for protection against the Indians, but its social advantages have ever been recognized in Quebec where, statistics show, rural population do not "leave the farms." Or as Mr. J. A. Grenier, Deputy Minister of Agriculture at Quebec says: "The closer settlement of the agricultural population due to the early French system of planning the land has been one of the factors preventing rural depopulation."

There are many splendid districts open to colonization in the Province of Quebec. Wishing to see the colonization movement direct itself as rapidly as possible and particularly towards the Abitibi region, the Government has settled a merely nominal fee on the agricultural lands situated there. Any settler may have a lot of 100 acres in Abitibi for $3.00 provided he fulfills certain ordinary homestead duties. This is the "Manitoba" of Quebec, the province where people ordinarily do not leave the farms. If they do they still go to Quebec.



As to soldier settlement, "We have already seen that, in obedience to the orders of the Imperial Government, free grants were given to militiamen who had served in the war of 1775 when the Province was invaded by the Americans. 232,281 acres were so granted to militiamen. Those who served in the war of 1812 were also rewarded in the same manner and received 217,840 acres for their services."

At the present time the township of Montgay is exclusively reserved for returned soldiers. Here there are laid out some 589 farms of approximately 100 acres each. Every soldier who makes a choice of a lot in this township is given a free grant but on condition of fulfilling the ordinary homestead duties which include the erection of a habitable house and barn, the bringing of at least 15 acres under cultivation and 30 months of continual residence on his land.

Ontario—

For the greater part of Canada that has been subdivided for settlement, the township may be regarded as the unit of land division. It is not within the scope of this lecture to follow a detailed history of township surveys in Ontario. For as might be expected from the irregular shapes and sizes of the townships as we find them laid out in this province, many changes in the system, or as it has sometimes been put, many changes due to lack of system have taken place.

Of the many irregular township surveys there might be mentioned that of Sandwich, in which disbanded French Soldiers settled before 1797—the Petite Cote Settlement fronting on the Detroit River. Beside the Single Front township surveyed as early as 1783, there were the Front and Rear, so-called, (1784-1797) and the Double Front introduced in 1818. Large areas were surveyed under the Double Front System, though it has been generally considered that lots of 100 acres make a rather small farm. In 1820 some 29 large townships or about 1½ million acres were subdivided. A map of Ontario published in 1821 shows the townships surveyed prior to that date as well as other interesting information. Canals are projected but in straight lines and apparently have not received the careful consideration that Mr. Noulan Cauchon, one of Canada's leading "town planners" has given to this important matter. The proposed scheme for laying out the remainder of the province, it is hardly necessary to say, was not carried out but it is of interest to note the suggested diagonal roads which, over square roads effect a saving in haulage of 29.3%. There is also shown a diagram illustrating what lands were to be reserved for the clergy and by the Crown and what lands were open for settlement.

Township surveys later undertaken include the 2400 acre block (1829-1851), the popular 1000 acre block, a modification of the former, and several modifications of the mile block system first used in the United States and also adopted in Western

Canada, the townships being six miles square with north and south and east and west boundaries.

In Ontario the systems of survey now in vogue are the "six mile" and "nine mile" townships. The former system was first introduced in 1859 and as explained was then apparently a direct copy of the township as laid out in the plans of the United States. As modified the "section" system has been in operation since 1874, and was for a period of ten years up until 1906 the system exclusively used in Northern Ontario, the townships being definitely related to each other and to certain "base lines" previously located. Lots are 320 acres in area, being one-half a mile from east to west with a depth of one mile. There are no road allowances provided in the original survey but 5% is reserved out of the area of each lot for roads or highways. By Order in Council dated April 24th, 1906, the Minister of Lands, Forests and Mines adopted the nine mile system of surveys. An inspection of the plan of such a township shows that roads are provided around each section of twelve 150 acre lots.

Having seen the folly of opening for settlement townships which are rough and which contain only a small percentage of good land, it is understood that the Government of Ontario has now provided that before a township is opened for settlement it must be inspected.

Northern Ontario comprises over 80% of the total area of the province or some 330,000 square miles. Agricultural land may be obtained here by purchase and in any of the eight districts except Temiskaming by free grant with ordinary homestead duties.

At a recent session of the Ontario Legislature, an act was passed authorizing the making of loans to settlers in the Northern and Northwestern districts of Ontario, the maximum amount of loan being placed at $500.00.

As to actual conditions in Northern Ontario the observations of Mr. William Henderson who should know his Northern Ontario well are in part as follows:—

"The hundreds of deserted homesteads seen everywhere in Northern Ontario, the apparent poverty of a great many of the remaining settlers, and above all, the dissatisfaction with existing conditions, together with a desire for the amenities of city life, can lead to only one conclusion. If the great clay belt, with its vast potential agricultural wealth is ever to support a thriving population, a policy in regard to land settlement, differing widely to that obtaining in the past must be put into force.''

Mr. Henderson has a scheme. Those Government officials who, in the past three years, have been bombarded with land settlement schemes would probably exclaim: ''Who has not ?'' In Mr. Henderson's scheme there are, as in nearly all schemes, many suggested admirable features, which your same Government officials will tell you are all impracticable. It differs radically, however, as to layout from the ordinary radial plan which, as you probably know, generally provides (though this is not a necessity) for wedge-shaped farms, radiating from a common centre. At the smaller ends of the wedges each farmer has his buildings and is thus brought into a community. Mr. Henderson's proposed scheme at Iroquois Falls provides that while farmers would have village community life with city conveniences they would be taken to and from their farms each day over well constructed roads by motor trucks which would also carry heavy produce. The farms could be rectangular, admittedly the most desirable shape for working.

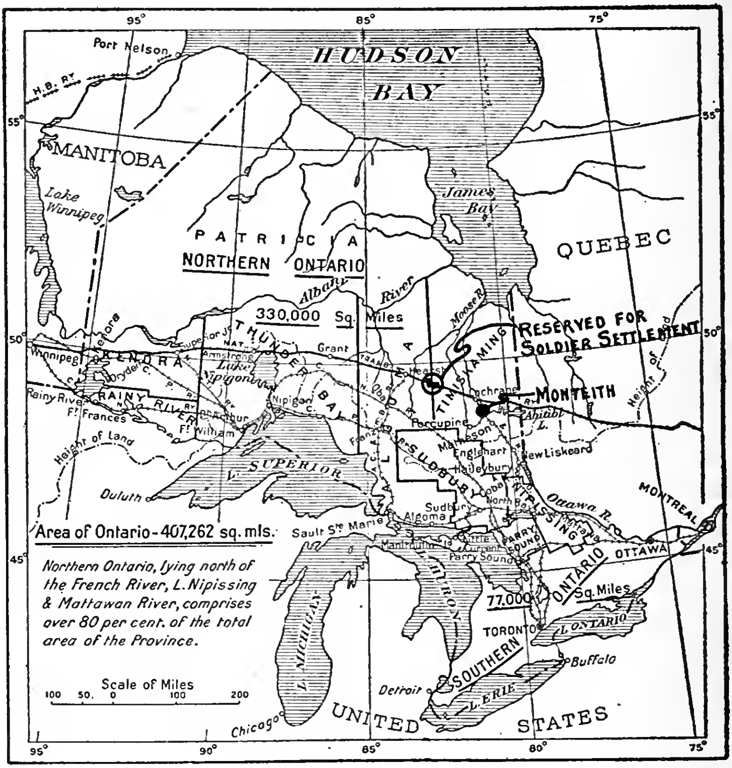
Ontario Soldier Settlement Schemes

Over a year ago the Ontario Government prepared a memorandum dealing with ''land settlement and opportunities for returned soldiers in the province of Ontario:—

All soldiers who wish to go upon the land and are desirous of obtaining some practical instruction in farming, and learning something of the conditions in Northern Ontario, will be sent to an agricultural training depot now being established on the Government Experimental Farm at Monteith.

It is the intention to train the soldiers in groups of 20 or 30 at a time and place them on blocks of fertile land along the line of railway, where they will be organized as a community settlement, under the direction of an experienced superintendent.

We are told that, ''farms containing not more than 80 acres will be laid out in such manner as to bring the different farm houses as close together as possible. As soon as a soldier desires to go upon a farm and work for himself, an 80 acre lot with a 10 acre clearing will be allotted to him. He will be supplied with the necessary machinery and tools, and such cattle, pigs, poultry, etc., as competent authority may determine upon, up to the value of $500.00 on easy payments. The co-operative method will obtain in the carrying out of the work in connection with the colony. The social side of life at the colony will be provided for, and ample provision will be made to make life enjoyable and comfortable at headquarters. A proper public building, where both religious and secular gatherings may be held, a school house and educational facilities will be provided.



Soldiers who may desire to go into fruit farming and chicken raising or other like agricultural pursuits, will be given free instructions at the public institutions of the Province.

The Ontario "Returned Soldiers' and Sailors' Land Settlement Act" of 1917 provides that land suitable for settlement and cultivation may be set apart and reserved for location by Canadians who have been upon active military or naval service in the present war.

It is probably under the provision of this act that three townships along the Transcontinental Railway near Kapuskasing, namely:—O'Brien, Owens and Idington, are being surveyed into 100 acre lots for the purpose of settling thereon returned soldiers who desire to go into farming in the northern part of the province. These 100 acre lots are laid out with the same frontage, namely: 25 chains 25 links as used in the nine mile system, but the concessions are only half a mile deep, making 18 concessions in the township instead of 12 under the nine mile system, the total number of farms in the three townships being about 1500.

British Columbia—

On April 1st, 1791, Captain George Vancouver, having been detailed to survey the west coast of America from Latitude 30 N. to 60 N. sailed from Falmouth and thirteen months later entered the Straits of Juan de Fuca and executed with extraordinary care the survey of the West coast. It has been said of Vancouver's surveys that "they were performed with a zeal beyond all praise."

Differing radically from early Eastern Canada experience we find after several centuries that on the west coast of our Dominion, surveys were practically synchronous with discovery and exploration and that in British Columbia some surveys at least preceded settlement, which but tardily followed.

Vancouver Island was not made a colony till 1849, while it was nine years later before British Columbia was formed. In 1859 the rule of the Hudson's Bay Co. over the few whites and Indians in these rather uncongenial colonies came politically to an end. Under Imperial pressure the two colonies united in 1866 under the name of British Columbia. At confederation in 1871, the province had a population of 36,000, one-half white.

To-day this most westerly province has the lowest capita per acre population in Canada, but a little over one per square mile (1911 census). Compare this with Prince Edward Island with 44 persons per square mile.

Of many parts of this mountainous province of British Columbia very little is known but those portions which have been surveyed or explored show immense area of cultivable land, estimated at thirty million acres, and tracts of timber—two hundred and fifty million acres of timber Crown land—vast coal fields, and liberal deposits of various minerals.

As to surveys "it would appear that the authorities of Vancouver Island prior to 1860, divided the southerly portion of the east coast into districts approximately five miles square, and subdivided these into blocks of 100 acres, measuring 20 chains by 50 chains. Unfortunately, a minimum of lines run and corners established in the field seems to have been sufficient warrant for the preparation of "official plans", which are still in existence and on which no details are missing, although subsequent events have proved that the surveys on the ground were very incomplete. The Colony of British Columbia, about the same date, employed the Sappers and Miners stationed at Sapperton to divide Crown lands adjacent to New Westminster into quadrilateral lots, usually 160 acres in extent; and while the soldiers left no official plans, and their field-notes consist of sketches only, in which many important details are missing, they did their work on the ground in such a conscientious manner that with comparatively little trouble the boundaries surveyed by them can be retraced at the present date. At the time the Colonies united and probably before that date, permission was given by Statute for pre-emption or purchase of an isolated piece of Crown land to be surveyed at the cost of the applicant, and it appears that for long periods the greater part of the land alienated from the Crown was surveyed in this way."

Two classes of surveys have been made in this Province:—(1) Government surveys made by land surveyors under the direct instructions of the Land Department. (2) Private surveys made by land surveyors under the instructions of and paid for by persons who had acquired the statutory right to a piece of unsurveyed Crown Land.

In the case of Government surveys where the nature of the country will admit, lands may be surveyed in the usual six mile square townships of 36 mile sections. In each quarter-section grant of 160 acres, a reservation for roads is provided; these roads are expected to be subsequently located in the most desirable places.

Under the "Land Act" Crown lands may be pre-empted, purchased or leased, a preliminary step in all cases being the planting of an "Application Post" at one corner of the land applied for by the applicant who subsequently must have a survey made at his own expense. Such location of land and the practical alienation of Crown lands before survey are features of land settlement peculiar to British Columbia. They are responsible to a great extent for the irregularity of land surveys in this province but were adopted on account of the mountainous nature of the country, which does not as a rule permit of a whole township being laid out, though certain areas are adapted to settlement. The "Land Act" provides that "all Crown lands may be surveyed into quadrilateral lots, bounded by lines run as nearly as may be true north and south and east and west." Such lots may contain an area of from 40 acres up to 640 acres, and are generally rectangular, though a body of water may form one or more boundaries of a lot.

"Were it possible that the survey of the country could be commenced over again", states a British Columbia departmental report of 1912 "it is probable that, while townships and sections would be adopted in the central plateau and in the wider valleys, elsewhere local conditions would govern the system adopted, and that in all likelihood lands would be laid out for settlement with a frontage on a located road, or a natural feature, as a river, lake, etc., and that the boundaries of such settlement lots would not be run north and south or east and west, that is to say, the only provision of the Statutes affecting land surveys which has been rigorously adhered to would be amended."

The "Land Settlement and Development Act" assented to 19th May, 1917, gives a very good idea of the lines on which the British Columbia Government is proposing to carry out colonization schemes. A Returned Soldiers' Aid Commission was appointed early in the second year of the war. It is in accord with the general principle advocated by that Commission that the Act has been drafted.

It seems to have been generally recognized in this Province that any scheme prepared for returned soldiers should as regards the general plan be available for other settlers. This seems essentially sound. There is not time to go fully into this matter of soldier settlement. But briefly it may be stated that there is no necessary relation between land settlement and the returned soldier, to whom surely there are other means of rendering Government thanks than by putting him where he may not want to go.

In British Columbia agricultural loans of from \$250.00 to \$10,000 are authorized to settlers by the Act but in no case to exceed 60% of the appraised value of the land The Board appointed under the Act is to have wide powers in making surveys, roads and in generally developing land for settlement.

"Every returned soldier, irrespective of rank, who purchases land from the Board shall be entitled to an abatement in the purchase price thereof to the amount of five hundred dollars" is the only clause in the act that has particular reference to ex-service men.

The Prairie Provinces—

In 1870 Manitoba became a province and we all remember that in 1905, the provinces of Saskatchewan, and Alberta came into being. But the original township surveys in these provinces are all made under the control of the Dominion Government and are undertaken by Dominion Land Surveyors.

For the system that was to operate in Western Canada, however, the advantage of continuity was early and clearly seen. The result is that now each township has a foreordained geographic position, subject of course to certain possible inaccuracies in surveying and having regard to the fact that surveys are necessarily astronomic and not geodetic. The successful carrying out of this comprehensive system is largely due to the present Surveyor-General of Dominion Lands.

The regular section of approximately one mile square is ordinarily divided into four quarter-sections of 160 acres each, for homesteading or other purposes. Road allowances of one chain or sixty-six feet in width are allowed along each section line running north and south, but now only along every alternate section line running east and west.

With but the exception of a few settlement surveys nearly 200,000,000 acres of lands under Federal control have been surveyed since Confederation in 1867, and what is probably as noteworthy, all practically under the same system of survey. The Dominion Lands System of survey operates in what was originally known as the Province of Manitoba and the Northwest Territories, though the provinces of Saskatchewan and Alberta now occupy a large part of what was then the Northwest Territories, into which the boundaries of Manitoba, have also extended. The three provinces of Manitoba, Saskatchewan and Alberta may be generally regarded as containing the lands best suited for settlement in the Northwest, but the two hundred million acres already surveyed represents less than one-half their combined area.

But what do all these surveys of 200 million acres mean ? Has effective colonization been carried out there ? Are the townships there laid out all settled ? Indeed no. It is only necessary to travel on any western railway to note the great expanse of unused or wild lands—lands admirably suited for farming as regards soil conditions and favourable proximity to a railway.

Examine a diagram of a township surveyed within the "railway belt." We find 16 sections for C.P.R., 2 sections for H.B. Co. and 2 sections for school lands. Only 16 sections out of 36, or 44% of the surveyed area available for homestead grants or for "that $10.00 bet with the Government that one can exist on 160 acres of land for three years."

Mr. Adams has found that but a tenth of the lands surveyed are under crop, and there is estimated to be three-quarters of that amount, or over fifteen million acres of vacant land within twenty miles of a railway ! Is it any wonder that some legislation has at last been resorted to in the prairie provinces in an endeavour to force idle lands into use or that the Returned Soldiers' Employment Commission of Saskatchewan resolved to ask the Dominion Government to select land for returned soldiers near railways.

Most of you who have given the western condition any thought no doubt recognize that the crying need of the hour is that lands near railways be brought into use and not that more railways be constructed. Generally speaking there is no need for more railways. Canada has now one mile of railway to every two hundred and thirty persons and has spent more per capita on transportation than any other country in the world. Our land grants to railways have been about forty-four million acres.

Unlike then most other provinces, Manitoba, Saskatchewan and Alberta have no Crown lands of their own. This has left the initiative for soldier settlement schemes with the Federal Government.

The "Soldier Settlement Act" assented to August 29th, 1917, provides for a "Soldier Settlement Board" of three commissioners. The Act provides for free entry of soldiers on Dominion Lands to be reserved for that purpose. The Board is authorized to loan any soldier settler an amount not exceeding $2500.00 for farming purposes, and this may be used in acquiring agricultural land not only in the West but in any part of the Dominion.

"In 1909, the Canadian Pacific inaugurated an improved farms policy. During that year a number of farms were equipped with a house and barn, a well and a fence enclosing the property. In addition, 50 acres on each were broken and seeded to crops. In the following year a contingent of British farmers were personally conducted by the company's agents from Great Britain and located on these ready-made farms. Under this arrangement a settler may proceed to earn an income on his farm as soon as he occupies it. The farms are sold on a 20-year-payment basis under the terms of which the price of the improvement is added to the price of the land. At first this type of farm was established only in Alberta, but since, the policy has been extended to include Manitoba, Saskatchewan and British Columbia.

"The Canadian Pacific also has prepared plans designed to encourage "returned soldiers" to take up farms. The lands set aside for this purpose are of two kinds, improved farms and "assisted colonization" farms. The former are included in selected colonies with distinctive military names, which have been improved by the erection of a house, a barn and fences, the cultivation of a certain area of land, and the provision of a water supply. Each colony will contain a central control farm in charge of a superintendent who will supervise the work of all colonists. Central control farms will be used for purposes of demonstration and as supply depots for male live-stock, and for implements to be used by colonists, as follows: One drill, one mower, one binder and one rake for three farms.

"There will be only a limited number of improved farms available, but land to an almost unlimited extent can be provided under the assisted colonization scheme. Under this plan farms must be selected by the intending colonist and then improved by him with assistance from the company in the way of advances of building and fencing material, live-stock, implements and seed grain. Both plans provide easy terms of payment for land over long periods, as well as direct financial aid at fair rates of interest if desired in the first year of occupation. Applicants for these lands must be "married men," physically fit and of good moral character, who can produce proof of having been in active service in the Canadian army or the British army or navy and who have had the experience either as farmers or farm labourers."

The Development Branch of the Canadian Pacific Railway Company has constructed several hundred farm buildings and aided settlers in farming several thousand acres. In 1916-1917 improvements were undertaken in connection with the farms being prepared for returned soldiers: 100 houses, 100 barns, 32 implements sheds, 190 miles of fencing, 25 wells. The major part of this work was completed in 1916 and the balance in 1917. Arrangements are now being made to install cisterns on 75 of these farms, which will be supplied with irrigation water. Twenty-five of these cisterns have been completed.

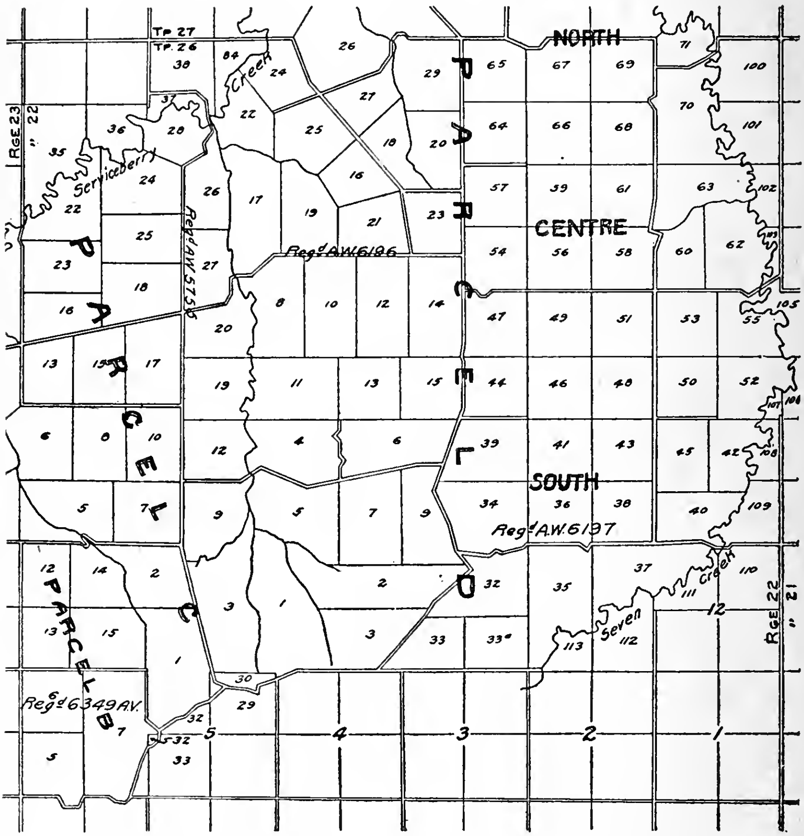
In the past the surveyor has generally had no voice in the matter of how lands for settlement were to be laid out; the system under which he was to work was pre-determined before he went into the field. He was only a land measurer, not by any means a planner and not even a surveyor in the full sense of the word—though, as explained, much more information has recently been gathered. A little additional government expenditure some years ago would have permitted of much useful information being gathered and recorded—information that, I believe, would have paid for itself many times over. But it is very difficult to make any government see the significance of such matters, especially as at the time of survey the land has but little value.

It is submitted that to aid in settlement full topography should be obtained of all lands to be surveyed and of many townships already surveyed.

Assuming that a topographical map with proper land classification be prepared using the present subdivision lines as a series of control lines, planning is then possible.

"Advanced thought"—the Surveyor-General of Dominion Lands, Dr. E. Deville, has pointed out—"does not favour planning by geometrical rule. It is held that the subdivisions of a tract of land must be adapted to its topography, that the roads must be located where they will be of most service, where grades are light and the soil suitable, and that every local feature must receive due consideration in devising the general scheme. There is only one instance of a subdivision of this kind in Canada; it is in one of the C.P.R. irrigated townships in Southern Alberta." Of this latter scheme in the vicinity of township 26 range 22 west of the fourth meridian (northeast of Calgary), to which the Surveyor-General refers I have gathered the following information from officials of the Canadian Pacific Railway Co.:—

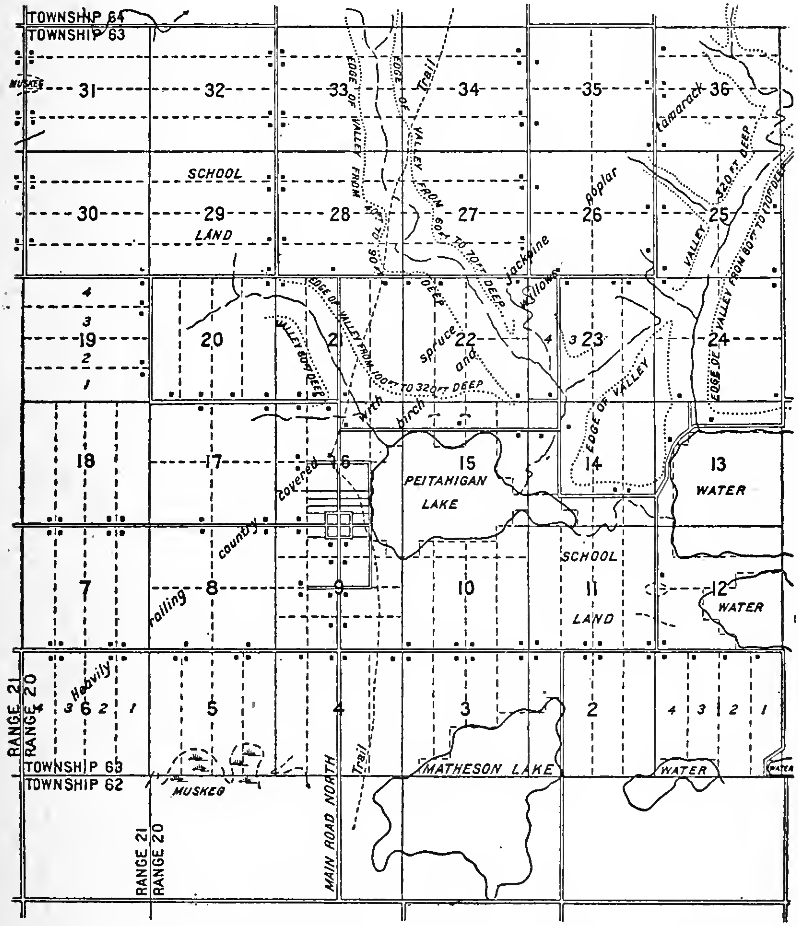
"This ("Grasswold") subdivision was made in 1909 under Mr. William Pearce, D.L.S. with the approval of the (Provincial) Government Surveys Branch. The land which is embraced in the C.P.R. Irrigation Block East of Calgary, had of course been subdivided according to the regular system of survey, but, as you will see from the map, being badly cut up by a number of creeks and coulees running into the Serviceberry and Rosebud River, many of the regular road allowances were quite impracticable and the district was peculiarly suitable for an experiment



in subdividing according to the topography. The soil is very good and you will not know from the blue print that the land has practically all been sold and is now closely settled."

Locating the roads in the most suitable places and the consequent change in the shape of farms to suit topography requires

TOWNSHIP SETTLEMENT PLAN
ADAPTED TO THE TOPOGRAPHY OF
Township 63, Range 20, West of the Third Meridian.
SASKATCHEWAN



planning. But in the C.P.R. scheme there has been no other endeavour made for social or economic co-ordination. Schemes that are based on the present rectangular system of survey as practised in the Northwest calling for 160 acre farms as nearly rectangular as local topography admits, but with a length and width to permit of closer settlement than at present and roads fewer in number and curved if required for desirable location would seem to be schemes possible of adoption at this time.

Mr. W. A. Begg, D.L.S., S.L.S., of Regina, has proceeded largely on these lines in his suggested changes. He has investigated an actual township (Tp. 63-20-3-) and has embodied his recommendations in a new plan which also makes provision for a community centre. According to Mr. Begg's plan of settlement the selection of a suitable site for this community centre should be the first step in the planning of a township. "The requisites of the location would be dry ground, a satisfactory water supply and a central position on two or more main routes through the township.

This planning of a community centre brings us into the field of town planning, which, as Mr. Adams has pointed out, is inseparably related to rural planning if both are to be successful.

In conclusion, I wish to express my thanks to all those government and other officials who have been so kind in supplying me with information and lantern slides for this lecture.

The President.—We would like to hear comments on this important subject from some of the gentlemen here that are interested. I would suggest that Dr. Klotz speak first.

Dr. Otto J. Klotz.—I am willing to open the discussion, but I will not take up much time, as there are others here who are full of this subject and from whom we should all like to hear. I have been delighted with the paper, a very exhaustive treatment of the subject covering the whole history of the country, and I am sure we are all grateful to Mr. Seymour for the pains to bring this mass of facts before us. Now that so much work is being done, we can see the difference as compared with the old compass surveys we had to make when we started out.. But Mr. Seymour has enabled us to understand how valuable those old surveys were in their time. I have risen only to set the ball of discussion rolling and I content myself with this expression of appreciation of the paper.

Mr. Noulan Cauchon.—I was greatly interested in Mr. Seymour's address. I had hoped to furnish him with a slide of the first plan of settlement in New France, made in 1641—or rather, the first in Canada made by one of the French Royal Engineers. It shows a number of farms down as far as the lower end of the Isle of Orleans. What I am particularly interested in at present are the new systems of settlement now proposed. They are proposed as soldier settlements; but, as pointed out by Mr. Seymour, a system of settlement should be justifiable on its merits. Personally, I have not been in favour of sending soldiers or anybody else into the wilderness. That has been a mistake. Ontario has been developing for thirty years on a speculative basis. The Western Provinces are over-railroaded by 45 per cent. They are paying $10,000,000 to $12,000,000 for supposed maintenance charges more than need be for the land served. All the lands in the West that are worth anything have passed from the Crown or are in process of passing; practically speaking, the Dominion Government has nothing to offer especially for any group of settlers, except land that is far from the railways. Lands with an aggregate of one hundred million acres near the railways are held by speculators so that nobody can settle near the railway except by paying high prices. For my part I would rather see railways divested of their subsidy lands and these lands opened for settlement. Not by seizure, but by expropriation. These lands were given to the railroads with a view to having them settled, and to the extent that they are still held by these companies the object of the subsidy has not been fulfilled. Therefore, I think the Government would be justified in taking back these lands on giving what the Government itself considers fair compensation. It was far from being the intention to give these lands for speculative purposes, and if the railways have deliberately witheld their lands from settlement by demanding high prices that is clearly against the best interests of the country. Now, the process should be reversed. And there are thousands of square miles of territory in the heart of Ontario and Quebec that should be opened for settlement. I speak particularly of Ontario, because I have been over a good deal of it. Even between Montreal and Toronto, as you travel on the train, you can see hundreds of square miles lying neglected for lack of drainage, or some other form of reclamation. I claim to have some knowledge of the cost of railway construction, and I hold that if the Government would pay one-tenth of what they have spent in building railroads for the carrying out of plans of reclamation, Ontario would be one of the very richest parts of the world. It is criminal to ask people, who have been brought up in Ontario surrounded by schools and other facilities of civilization, to take their children and go to such places as have been shown here to-night, even though those places are boomed as though already built. It will be time enough to settle those places when we have fifteen or twenty millions of population. I am one of those who believe that we are going to have very little immigration after the war. I hope I am mistaken, but I do not see where the immigration is to come from. Consider our economic situation.. This country has piled up an enormous debt on account of the war. Great Britain is buying here everything she can, but buying at our prices. She is furnishing our soldiers at the front, but all this will be charged back to us plus the cost of carriage and distribution. So, it is a poor consolation to us to know that high prices are paid, for these prices will all appear charged up against the country in the final book-keeping. We must pay by further production—for that is the only way by which a country can pay its debts. When we set out to pay the shot, we shall have a population of about seven millions, and it behooves us to utilize every unit of man-power in the mechanism of production. If you send a man into the wilderness whether in Ontario or into Saskatchewan you put him into a position where he is so far from market that he cannot cultivate at a profit for the next ten or twenty years. That simply postpones the time when he is able to help in the production which assists in paying our debt. The better plan is to reclaim the parts of the older provinces that can be reclaimed and increase their productivity. This will enable your man-power to produce at its maximum. The sooner that is done, the sooner we can pay our debts and begin to accumulate a reserve of wealth. Our natural resources are all that Canada can depend upon to redeem herself. You may say that it can be done in any case, but what I contend is that it should be done with the least waste of effort by avoiding the errors of former years. All the money that Canada pays on these guaranteed bond issues is in reality paid, through the railways, to the speculators who are witholding the land from settlement—we are paying it to enable them to withold the land until the filling up of the country enables them to secure the price they want. The shortest way is to take back the lands given as subsidy and not settled or sold. In the nature of things, you cannot have close settlement now in the West. The only thing there is wheat growing and, though, it is carried to the extreme, it is the best thing for the country at the present. But to have a return worth while the settler must get his land at a reasonable figure and he must not be too far from market. But in the East the plan is to reclaim needed areas. I have in mind two areas the production of which could be quadrupled. One is east of a line drawn from here to the

St. Lawrence at Cardinal. West of that is high land, rising to the Rideau. The Rideau would furnish irrigation, and there is opportunity for drainage into the Nation River. This area could be developed and cultivated intensively. But that would mean resurveying to lay out the land in the most convenient way. Intensive cultivation is possible only in the heart of settlement and where there are markets. And for this territory you have not only the markets of Ottawa and Montreal, but also within reach such a great market as New York. Produce could be loaded on express cars and unloaded in the morning in any of many markets representing an aggregate population of not less than ten million. Such a form of settlement would be ideal for the returned soldiers. And all through this territory we have enormous clay deposits which may be made the basis for the manufacture of brick for houses, tile for drains and other products, forming the nucleus of village settlements. I recommend this to the attention of the surveyors who know what the country is. I do not think that you should resurvey the West. Too much of it has been surveyed at considerable expense and a good deal of the work has been done in a hurry. At the same time, the system of surveys is an admirable one. I have lived in the West and speak with some knowledge. The trouble is the people are not on the land. I do not blame anybody for that—I do not say that it is more the fault of one government than of another. It was the result of a mistaken public opinion. We have been developing on the skeleton basis, trusting to the future to put flesh upon that skeleton. The time has come when we must turn from pushing development to the outlying parts of the country and develop the parts already settled.

Mr. P. A. Shaver.—Mention was made by Mr. Seymour of an instance in which the C.P.R. changed the original township subdivision. This subdivision was within the Irrigation Block but on account of the deep coulees, some of them as much as ninety feet deep, the water could not be carried across. To-night you have heard a favourable criticism of this scheme, but it is such as would be given by those instrumental in the planning. I think the difficulty could have been met by a different system of posting. The posts put in were wooden plugs, and they were soon knocked out. Then there had to be a resurvey and somebody had to be given the job. That is the criticism expressed to me by a surveyor who had had experience in laying out town sites and irrigation lands.

As to those ready-made farms, the C.P.R put up the buildings a good deal cheaper than you or I could. I may be telling secrets, but I was engaged in making estimates for that company, and when clear lumber was selling $28 to $30 a thousand in Calgary, we were estimating on the timber work there at $14 a thousand on the work.

Now, as to the railway lands. The division made was on this basis, 5 per cent for school lands, 5 per cent. for the Hudson's Bay Co., 45 per cent. homesteads and 45 railway lands. When the homesteader proved up and was ready to sell at $15 the railway land was at $16, and when the homesteader raised to $16 or any other figure the railway lands kept a little ahead. Fifty per cent. of the land is not taxed either for schools or for any other public purpose. The Hudson's Bay lands are taxed and so are the lands of the settler, but the school lands and railway lands are not taxed. I enquired once how railway lands in one section were being sold and was told they were not being sold. I asked about the others and was told once in a while the settlers' lands are sold. That explains why the railways are not paying dividends. I am not trying to "get back" at the C.P.R. they used me well. But this holding of lands from settlement is one reason why settlement has to be driven away back. I saw settlers last summer who were living nearly a hundred miles away from a railway. As to the planning of rural communities I think the farmer wants a square field. He would rather take a crooked line to market than a crooked line when he wants to plough a furrow. These plans look alright on paper, but they are not attractive to the farmer.

Dr. E. Deville.—Mr. Seymour is to be congratulated on his paper; it must have involved a great deal of research. One matter which has some connection with his subject, is the system adopted by the C.P.R. at the inception for managing their lands. The Land Commissioner of the C.P.R., Mr. Hamilton, was formerely an officer of our Department. When the company got its land grant of 25,000,000 acres he set out to devise a plan to sell that land to the best advantage. He inaugurated a kind of survey of the whole land grant, employing eight or ten parties of a few men each. These were not surveyors, but men somewhat conversant with surveying. Each had a compass and a hand level. Each section was divided into squares and thoroughly explored, and a topographical plan was made of it. Mr. Hamilton published a little manual, a copy of which I have in my office.

It struck me that this was a very good plan, but for some reason it was discontinued. The C.P.R. was not as wealthy then as it is to-day, and the survey may have been found too expensive.

Another point that I would like to explain is that generally these radial settlement schemes are not put forward by surveyors; they are rather skeptical.

Mr. Cauchon.—I desire to interpose for another moment to draw attention to a fundamental matter which Dr. Deville's remarks have brought to my mind, that is as to the shape of the farm. The idea of a radial system is consistent with old country methods. With small farms and intensive farming, you can easily have a hamlet at the centre around which the farms are grouped.

But when you have large farms, your radial system becomes difficult and inefficient.

Dr. Deville.—I was looking recently at a map of a section in Northern France in which population is very dense and in which they have community life. In such places it is easy to arrange that those who cultivate the land shall live in villages. Suppose that the farms are ten acres each. That would mean that you could have fifty families on an area of five hundred acres, which is less than a square mile. It does not matter where a man's land is within that area, for it could not be far from the village. But if you have fifty families with one hundred and sixty acres you will have an area of something like twelve square miles, and some of these farms would have to be far from the central village. In the big European estates, land is cultivated by men who live at the centre of the estate. There may be a group of ten or twelve houses, making a small village, with its carpenter shop and other industries or services. Sometimes the estate is too big to be cultivated from one centre, in which case there is one main centre with what might be called sub-stations. Or the outlying parts of the estate may be leased to farmers who pay half their crop as rent, the owner furnishing implements and seed. In speaking of these radial systems, we must bear in mind the difference in conditions between Europe and Canada.

The Secretary—The gentlemen who have spoken have made very appropriate remarks about Mr. Seymour, but I think it is only right that we should recognize also the great assistance rendered by Mr. Morgan at the lantern.

The President.—I was in Southern Saskatchewan last fall in a thickly settled township, nearly every quarter-section of which is occupied. I talked to several families and told them of these proposed plans of radial surveys and asked them if they would like to have their neighbors closer than they are, and their reply was "not on your life." I think that in any township where every quarter-section is settled you will find people quite satisfied to have their neighbors at the present distances. Those who are working farms do not have much time in the summer season for social gatherings, and in winter they have a good deal of leisure so that distance does not count. We offer Mr. Seymour our hearty thanks for his most instructive and entertaining historical review of early surveys and settlement, and also to Mr. Morgan for efficient help rendered at the lantern.

The meeting adjourned until 10 a.m. Thursday.

SECOND DAY—MORNING SESSION.

The President called the meeting to order shortly after 10 o'clock, and, without preliminaries called for the reading of the first paper named on the program.

Mr. T. E. Brown read a paper on Accounts, as follows:—

ACCOUNTS.

BY T. E. BROWN, B.A.

When I was requested to prepare a paper on "Accounts," the first thought that occurred to me was what a dry and uninteresting subject I was to write upon. Moreover, I believe there is no branch of the subject that presents fewer points of general interest than survey accounts. However, I have endeavored to gather a few points and to express opinions thereon with the object of clearing up any obtuseness or misunderstanding that may exist in the minds of surveyors as to the views of the Head Office on the matters in question.

The main essentials of accounts are clearness and accuracy; calculations must be carefully made; entries must be clear and unmistakable; vouchers must be arranged in neat and proper order. It is not the business of the Head Office to arrange or to complete a surveyor's account. The condition of the accounts presented to the Head Office is a good indication of the conditions that prevail in the survey camp of that particular surveyor.

Slovenliness, inaccuracy, carelessness, neglect to secure vouchers or loss of vouchers is a sure indication of slipshod, haphazard methods about the field camp and in the management of the party. Show me a surveyor whose accounts are in good order, neat, clear, accurate and complete, and I will show you a surveyor whose survey camp is exemplary in all the conditions that make for order, cleanliness and health; for a contented, cheerful and willing party of co-workers. A high scientific training, it seems to me, calling for care and accuracy in arrangements, for fullest attention to details and results should produce men whose habits are the epitome of neatness, of accuracy and of completeness: it is a strange fact, however, that in many instances the most careless, inaccurate and incomplete accounts are furnished by men whose scientific training is of the highest order. It goes to show that the best training is obtained from a proper mixture of the practical and the scientific or theoretic.

At the opening of the season you are required to furnish an estimate of the expenditures you will be obliged to incur to organize and carry on the work for the first month or two. A certain sum is then advanced ,the amount depending upon the estimate of expenditure. When applying for further advances on account, care must be taken to give full details of the expenditure of the amount previously advanced and, in a separate column, details for future expenditure up to the sum applied for. In the Head Office record is kept of the size and organization of your party, the rate of pay of your men and as far as possible of all conditions under which the survey is being carried on. If through unforseen circumstances you have been obliged to depart from the prescribed conditions or regulations full explanations should accompany the estimate, otherwise the advance may be held up. The Department would not be justified in advancing money without a clear understanding of the surveyor's need.

When, in your judgment, a radical departure from the regulations or instructions is advisable, approval should be obtained (by telegraph if necessary) before incurring unusual expenditures. This requirement may appear unreasonable by an office which leaves so much to the judgment of its trained field officers. The appropriation voted by parliament is based on estimates carefully prepared for each branch of the work. Perfect control of expenditures is therefore essential. If Jones were to buy an automobile without authority, Smith pay his men fifty cents a day bonus, Robertson allow railway fares contrary to regulations, Brown employ three or four axemen over the number allowed by his instructions and so on for every other party in the field, the end of the year would see us burdened with a heavy over-expenditure and obliged to ask Parliament for a supplementary appropriation. The surveyor interested in his work will assist the Department by restricting expenditures within the estimates, rather than embarrass by needless and reckless purchases.

Every effort is made by the Head Office to facilitate the work and to assist the surveyor by prompt remittances in response to estimates. Money will be placed to the surveyor's credit with any bank he may designate. He is expected, however, to select a bank convenient to the field of operations: exchanges on surveyors' cheques is not paid by the Department.

The surveyor's salary is paid for every day spent in connection with the survey, including Sundays, from the time he leaves home until the completion of the work. The account for personal service on field work can be checked only through a study of the official diary. Detailed entries of the surveyor's personal movements are, therefore, insisted upon. It is useless to expect remuneration for time spent otherwise than upon actual survey operations, no matter what the cause of absence, nor how unavoidable. This may seem a hardship or an injustice under certain circumstances, but unfortunately the power to rule otherwise does not lie with any officer of the Department, not even with the Minister himself. Should the Surveyor-General through sympathy or otherwise, recommend it and should payment be made by the Department, the account would be rejected by the Audit Office and a refund demanded.

The account for personal services at office work should cover time actually spent on the preparation of final returns, reports, accounts, etc., connected with the survey. The time necessary to prepare each surveyor's returns, reports, etc., is estimated from a standard scale in the Head Office. If the surveyor charges a longer time than that estimated, his returns are given a close inspection to ascertain if there is any reason why they should occupy a longer period in preparation than the standard. If there is none, the account is reduced to the estimate and the surveyor advised. He may, if he wishes, then give explanations to justify his charges: the explanations will be given careful, sympathetic consideration.

As a rule, there is little difficulty with the paylist. I would point out, however, the necessity of filling in the entries for all columns. The one most frequently neglected is the column of deductions for absence, etc. If the employee was paid for full time the word "None" or a cipher should be entered in the column for "Deduction". If he was not paid in full the number of days deducted should be stated. No departure from the approved rates of pay should be made nor should bonuses be allowed except after reference to and with the approval of the Surveyor General.

How careful surveyors should be in this regard was clearly illustrated a few years ago. The rate of pay for labourers on survey parties in the Railway Belt, British Columbia, was set at two dollars per day, while that in Manitoba, Saskatchewan and Alberta, remained at $1.50. A surveyor in charge of one of our subdivision parties in the Peace River Block, which as you know lies within British Columbia, paid off his men at the rate of $2.00, although they were engaged at Edmonton. This information soon reached the ears of the men employed on parties in Alberta, only a few miles from the Peace River Block, and also engaged at Edmonton. They saw no good reason for the discrepancy in wages and immediately demanded the same pay. Being refused by the Chiefs of their parties they appealed to the Minister. Much to his regret the Surveyor General was obliged to report that the surveyor in the Peace River Block had misunderstood the instructions; that the higher rate of pay could not be allowed by the Department; the difference would have to be borne by the surveyor himself unless he could obtain refunds from the employees. The Head Office is always anxious to protect the surveyor who acts in good faith, but in this case to protect the surveyor would have brought about a deluge of applications for the higher rate of pay from all the men employed during that season.

It has been the practice of some surveyors, in recent years, themselves, to witness the signatures of the payees on the paylist. A moment's reflection will be sufficient to satisfy anyone that the practice is objectionable. An uninterested party should act as witness; but it is satisfactory if one member of the party witnesses the signature of another.

The transport account is usually the bulkiest and most important part of a survey account. It is preferable that vouchers and expenses should be numbered and entered in chronological order. In the Manual, surveyors are asked to number their vouchers in the lower right hand corner. If the number who comply with this request is a criterion of the number who read and study the Manual the prospects for proficiency on Dominion Land Surveys is not bright. However, in face of the splendid results attained in the field work we cannot become pessimistic, but are forced to conclude that the item has been overlooked or regarded as of minor importance. Dominion Land Surveys of recent years have become famous for accuracy and efficiency; why not carry this efficiency a little farther, and systematize your accounts and reports ? Let carelessness, slothfulness and inaccuracy in such matters be relegated to the days that have gone, to slumber with the ignorance, absurdities and inefficiency that characterized early days of surveys in Western Canada. All honor to the men who underwent the trials and hardships incident to these surveys; their hearts were right; they did the best they could, but they had not the finished training of the surveyor of to-day.

To return from this digression to a consideration of the transport account, it is desired to bring to the attention of surveyors the advisability of using Department requisitions as far as possible to obtain railway transport, not alone for the surveyor, but as well for his assistants and labourers. To facilitate checking, care should be taken to make it clear, by endorsement on the back, for whose use the ticket is intended. The main objection to cash payments for transportation is the difficulty of procuring satisfactory vouchers to cover the expenditures. When railway tickets are procured on requisitions and are not used they should be forwarded to the Head Office where application for refund will be made. Confusion is likely to result if the surveyor applies for the refund himself.

After careful consideration a list was prepared and inserted in clause 431 of the Manual, of articles which comprise camp equipage, to be furnished by the surveyor and for the use of which he is paid a per diem allowance. Nevertheless the Head Office is constantly receiving requests to pass charges for such articles. The insertion of items of this nature in the accounts leads only to confusion and disarrangement. The camp equipage allowances are quite liberal and only in very exceptional cases would the Head Office ask the Audit Office to pass additional charges under this head.

When a surveyor sells horses or outfit the proper procedure is to deposit to the credit of the Receiver General the proceeds of such sales and to forward to the Head Office the receipts for deposit together with a certified statement of sale. The transaction in this case will not appear in the surveyor's account. However, when the amount involved is small this procedure is not insisted upon; the surveyor may debit himself with the proceeds and include the item in his accounts, accompanied by a suitable voucher.

While on the question of vouchers, it might be well to remind you that a voucher does not mean simply a receipt for money paid or a statement of money received. It should give the place where the transaction occurred, the nature of the transaction, the amount of money involved, the details as to quantity and price unit when goods are bought or sold; when service is rendered, the nature of the service, the period of time, and the rate of pay. As far as possible vouchers from merchants, firms and companies should be on their official forms, stamped with firm's stamp and initialled by the party receiving payment. It is a mistake to think that it is not necessary for a surveyor to check the bills of merchants, railway companies or of others. Errors are frequently found therein and there is no recourse but to charge the amounts against the surveyors' accounts.

The miscellaneous account should contain all items of expenditure not properly chargeable to any of the other accounts.

Details should not appear in the balance sheet. Totals only should be entered on both the debit and credit sides. When it is necessary to furnish explanatory details they should be given in statements attached to the accounts.

In conclusion I wish to state that in the past few years there has been a marked improvement in Dominion Land Surveyors' accounts in every respect. There has been a corresponding decrease in work and worry for the accountant staff at Head Office. Congratulation and thanks are accordingly heartily extended. With but slight additional efforts each man can achieve a complete anl almost perfect system and do much to eliminate the trivial misunderstandings that crop up now and again.

The President.—Perhaps we might hear some remarks from some of the gentlemen whose accounts have been criticized.

Mr. Pierce.—In the case of a freight bill, if there is any overcharge they take it from the surveyor. But, if it is the other way what do they do ?

Mr. Brown.—The circumstances must be considered. If the man who suffers by the undercharge were a labourer we would report it to the surveyor and ask him to do the man justice, unless the amount were a trifling one, in which case we would not take the trouble. If the surveyor has been overcharged on freight and only the correct charge has been allowed him, he can get a refund from the Company.

Mr. Boulton.—Why is it necessary to have an account made out on the official paper of the business concern you deal with ?

Mr. Brown.—I understand from Dr. Deville that some years ago it was thought that it would be a good idea to have all vouchers on the form supplied by the Department. But the result was that the surveyor would buy goods, make out the bill and have it marked paid and signed. The result was that we might receive from Mr. Boulton a voucher simply saying, "Five thousand dollars for supplies". So, the form was abandoned. Besides, when the bill is on the regular billhead of the firm, it is better evidence that there has been a bona fide transaction.

Mr. Boulton.—It is not always possible to get a voucher on a firm's business paper. It is very often hard to get them even to initial the voucher.

Mr. Brown.—I do not see why a firm should make any difficulty about doing such a thing for a surveyor who does business with them. Many firms have what they call debit forms and in that case all they have to do is to mark it paid.

Mr. Boulton.—A good many of these forms are stock forms and have not the name of the firm.

Mr. Brown.—In the case of a small, ordinary transaction, the office would not insist on having the account on the firm's paper. We are not unreasonable in these things, but, as far as possible the surveyors should get the receipts on the bill-heads of the firms they deal with.

Mr. Jackson.—Is it necessary to have a voucher when you buy a berth in a sleeping car ?

Mr. Brown.—The stubs from your ticket will be sufficient.

Mr. Jackson.—But there is only one stub. You have no duplicate.

Mr. Brown.—No, one is enough. The charges are fixed and we know what they are.

Mr. Blanchet.—What do you do when the account is with an Indian who cannot write ?

Mr. Brown.—We accept the declaration of the surveyor—I do not mean the statutory declaration, but simply a declaration over his own signature.

Mr. Cowper. Are tools for a Ford car chargeable as transportation or as camp equipage ?

Mr. Brown.—The question of Ford cars is difficult. Cars are changing from day to day and, apparently the tools with them. Some surveyors have to buy four or five wrenches in rapid succession. I suppose they jump out of the car. But, seriously, I think that tools should be charged as camp equipage. However, if you can show good reason why they should be allowed, they will be allowed.

A Member.—It may be that by the expenditure of fifty cents for tools and with a little labour on the part of the surveyor the car could be put in running order which otherwise would have to be sent to the shop under the charge of a dollar an hour.

Mr. Brown.—The surveyor is put on his honesty to do the best he can for the Department while he is out. He should use his judgment in buying things or doing without them. But, if the surveyor is not to buy anything, then the allowance made him is away beyond what is proper and necessary.

The Secretary.—Did Mr. Brown ever consider the question of supplying medicines for surveyors. I have several times suggested to the office that surveyors should be furnished with an outfit of medicines as most other organizations are that are sent miles away from civilization. In my own experience of many years in the field I have always spent money for medicines which could not be charged. In case of accidents and so on, some simple medicine ready at hand may save a man a serious illness and save the time during which he would otherwise be laid up at the expense of the Government. I think that is a question that should be considered by the Association.

Mr. Brown.—That is a question I have not considered. I think it a very good one, and I know there are surveyors who go out now pretty well stocked with medicines. They know their needs best, I suppose; the medicine that will suit one will not suit another. I would like to hear the views of some surveyors on the point before expressing an opinion.

The President.—In the Geodetic Survey and International Boundary Survey Branches, the Surveyors are authorized to purchase medicines. Each party has a little medicine case costing six or seven dollars.

Mr. Akins.—If anything happens to a man in the field the surveyor is in a measure held responsible, yet he is not provided with the means necessary to help the men in case of sickness or accident.

Mr. Jackson.—I think the office should bear the cost of medicine. Besides, if we had the recommendations of medical authority, the surveyor would know better what to take with him.

Mr. Brown.—An allowance is given the surveyor to provide for miscellaneous expenditure. That allowance is not simply a bonus, and the question is whether it properly covers medicines as well as other things. At present these are counted as camp equipage, and so are tools. It is simply a question of where the line is to be drawn.

My attention has been drawn to a point in my paper. It is claimed that there was a mistake in the instructions issued as to the pay of men in British Columbia. The instructions were that men employed on surveys in the Railway Belt got $2 a day. But the men in the case referred to were not in the Railway Belt. The surveyor had misunderstood his instructions and had taken it to apply to British Columbia.

The President.— What surveys are carried on in British Columbia outside the Railway Belt?

Mr. Brown.—In the Peace River Block—about three and a half million acres.

The President.—We owe Mr. Brown a hearty vote of thanks for his very valuable paper, and for his suggestions, from which, I am sure, we shall benefit.

The Secretary.—The next item on our program is a lecture by Dr. Gliddon. The Doctor will be here in a short time, and I would suggest, that, meantime, we might consider the notice of motion given by Mr. Seymour of an amendment to the constitution allowing for the formation of local Branch Associations.

The President.—Mr. Seymour will explain his motion.

Mr. Seymour.—The motion of which I gave notice is as follows:—

"Whenever it shall be the desire of ten or more members of the Association residing within a radius of twenty-five miles of any local centre they may petition the Executive of the Association to form a local branch of the Association and submit their by-laws for approval of the Executive, who are hereby empowered to deal with all matters relating to local branches."

It seemed to me and to some others that in places where there are a number of surveyors who could meet during the season it might be of great advantage to enable them to form a local organization under this Association to engage in such activities as rightly belong to the Association as a whole. In this we should be following the example of the Canadian Society of Civil Engineers, which has branch societies in many of the large centres. Of course, we had particularly in mind Ottawa, which is headquarters for so many surveyors. According to the motion the constitution of each local Association would be subject to approval of this Association as a whole.

Mr. Cowper seconded the resolution.

The resolution was carried.

Dr. W. O. Gliddon was then called upon, and gave a lecture on "First Aid," which was, in substance, as follows:—

(This address as delivered was not reported and Dr. Gliddon has been unable to find time to write up a synopsis of it.)

The President.—It is a great compliment to us that Dr. Gliddon should take the time to prepare and give us this address, and I am sure we all appreciate his kindness. On behalf of the Association I extend to Dr. Gliddon our cordial thanks.

The meeting then adjourned to resume at luncheon at 12.30 p.m. at the Chateau Laurier.

THE LUNCHEON.

The after-luncheon discussion was as follows:

The President.—Gentlemen, I have the pleasure of asking the Minister of the Interior, the Hon. Arthur Meighen, to address you. Knowing what a busy man he is; knowing the many calls upon his time and attention, we appreciate all the more his presence here to-day. We have with us also Hon. Dr. Roche, ex-Minister of the Interior, a gentleman who took a deeper interest in our profession and our work than any of his predecessors. We shall always have a pleasant recollection of the six years we spent under his ministry. In all our claims as surveyors we look especially to the public representatives from the West for support. They have always seemed more in sympathy with us than the others. They appreciate more the difficulty of such labours as ours in a new country. The fact is, we surveyors have a sense of proprietorship in the great Northwest. We were there at the foundation of a great prairie empire, and in the early days of its organization, and in its organization, surveyors took a very prominent part. When I first went to the West we acted under instructions of the Secretary of State. In a couple of years the claims of our work upon the Government resulted in the establishment of the Department of the Interior. In fact, we claim that we are the "raison d'être" of that Department. Aud under that Department we have worked faithfully for half a century. We were the first immigration officers. We were the first conservation men, the first men who tried to have the Government adopt laws for the protection of game and the preservation of the forest. Look over the reports of the early days, and you will find that in nearly every case the surveyor was begging the Government to take measures to protect our resources. We have served faithfully in the past, and we are serving faithfully to-day. We have overseas 136 members of our profession, most of them in the trenches, and we are proud of the work they are doing there. As to the future, we who have not the privilege of serving overseas, look forward to serving on this side in the development of our country. We think the surveyors, from the experience they have gained in all these years and the knowledge of the growth of settlement and of development generally, are well fitted both to advise and to help in solving the great problems that will present themselves in the days of reconstruction. We have in our membership quite a large number of surveyors who have been engaged on the surveys of Dominion Lands during the last ten or fifteen years. These are generally young men, energetic and of proven executive ability as well as of proven integrity. I think they have a great claim to be considered and that their plea to be allowed to serve in solving these problems should be entertained. I will now ask the Minister of the Interior to address this meeting.

Hon. Arthur Meighen, Minister of the Interior.—Mr. President and gentlemen, it is no sacrifice on my part to be here on this occasion. The hour of your luncheon has been chosen to suit my engagements and even the moment of arriving to speak. Therefore, very little time indeed is occupied that could possibly be devoted to the business of my Department, and what is occupied is very profitably used so far as I am concerned. It is a matter of regret to me that I have not, as yet, been able to come as closely in touch with the officers and employees of the huge branches of the huge Department of the Interior as I should like to have done and as it is my duty to do. That duty will be performed as soon as possible and to the best of my capacity. The vast majority of you I do not know. Most of you are connected with the Government in your professional capacity. Most of you are young men whose acquaintance with the Department and whose professional careers are in the initial stages. But I stand now between two men, one of whom, he on my left (President McArthur) was a pioneer in the little town where I make my home, some years before I was born. At that time he was engaged in the profession which has been his life work. He on my right, Dr. Deville, held what was virtually his present post in the Government of Canada before I saw the light of day. The men who thus stay with their work and develop with that work are the mainstays of our country's advance. The surveying profession as a profession, however, is not very far afield from the line of life I followed before I came to Ottawa. The legal profession comes in close touch with surveyors. We both, as you know, make it our purpose in life to keep the public in the right line. I recall that many a time, as I encountered prospective law suits, one of our great difficulties was to find enough money to pay the surveyor. After that, of course, came the difficulty of paying the lawyer—but that was a very minor consideration. And in many and many a suit in which I have been engaged, the surveyor was the star witness, and I found that the capacities of members of the profession to differ and to support their antagonistic claims was quite the equal to that of the medical profession or even of the legal profession itself. It is a good thing that surveyors have a central organization, thus developing a community interest, for without that, professional life is not what it should be. A man is a better member of his profession if he takes an interest in it as such. The fostering of a community spirit, the spirit of fellowship among members of a profession, does much to add to the interest you take in your work, making it a real work of delight instead of a drudgery as a mere means of making money.

You have, as your President has said, performed a real function, especially in this Dominion. Surveying goes hand in hand with civilization. Look at a map of the country and follow the work of the surveyor and you follow the progress of civilization and development. That is certainly true of our Dominion. In the earliest times, when the facilities of transport and of passing from one part of the country to the other were very meagre, and when the hardships were great, the surveyors made the surveys of which the whole Dominion is now reaping the benefit. That work as a whole has been well done, indeed astonishingly well done. None know that better, I think, than the members of the legal profession. I say, it is astonishing to see the precision with which in those early times the work of surveying was carried on. On the whole a very limited amount of corrective work has needed to be done in these latter days. The reliance that can be placed upon the work of your profession in these times is a tribute to the education, the integrity and high character of the men who performed that very difficult and very useful service. We have now reached a stage in the progress of the country where the same class of work under like difficulties is not the order of the day, but we are far from reaching a point where the work of the surveyor becomes in any sense unnecessary. On the contrary, more, perhaps, than in any other profession, the variety of your service multiplies and increases. You apply your work now to different ends and are engaged in the performance of rather different duties from those of a former time. That is to say, we are not now so much extending settlement into the far remote regions and laying out more quarter-sections of land, but we are utilizing the same qualifications and the same services in more detailed work in the more thickly-settled parts of our country. It seems to me that the near future will offer many opportunities for new and valuable services on the part of the land surveyor. We are reaching a stage now where a new development is beginning. There is going to be a demand, entirely unknown in our previous history, that will present difficulties to the generation coming on. We are seeing the situation now as through a glass darkly. Our soldiers are coming back. They are here now in their thousands. They will soon be here in their tens of thousands, and later in their hundreds of thousands as we all hope and pray. With the return of our Canadian soldiers and with the coming, as we hope and believe will be the case, of many of the discharged men of Britain and the allied countries who seek a life in Canada as more to their liking than the life they pursued before the war, there will be a pushing out of civilizatian, there will be a spread of settlement that will demand more and more of the services of your profession. Only yesterday the personnel of the Soldier Settlement Board provided for by my honoured predecessor, Dr. Roche, was named. These men are now set out upon a path which is fraught with new and grave difficulties, it is true, but fraught also with possibilities of usefulness to the country that belong to very few organizations of our day. We hope that the progress and the usefulness of that work will be such that the call will come to the surveyor to join them and to pursue his profession in association with them. It is not the desire of the Government nor my own, that any effort should be made to press the returned soldier into the remote parts of our country, and especially to press them there against their will. The best is none too good for them. It is our hope that every facility will be offered and the way made easy not only for their settlement in our outlying lands should they so desire, but for their settlement among ourselves in the more thickly populated parts of our country. Of course, it is the hope of the Government and of Canada, that as many of them as possible will choose settlement upon the land whether outlying land or land near the centre, because in that way they can undoubtedly best serve in the development of our country and, as we believe, can best serve their own interest. But it is no purpose of ours to isolate the returned soldier in outlying parts of the country. Many, however, it is hoped, will be possessed of the spirit that seeks settlement in the newer and untried parts of the country and for these especially the services of the surveyor can be usefully employed. In this whole question of soldier settlement, however, we shall never win through, nor nearly through, without associating ourselves with the profession you represent.

I thank the members present for the honour done me in asking me to be here. I was very pleased to hear the tribute paid by the chairman to my predecessor, Dr. Roche. I cannot express a higher hope than that in serving my country in the same capacity I shall serve it with the same fidelity, with the same success as he, and that I shall win as high a place as he holds in the regard of the officers and employees of the Department.

Hon. W. J. Roche, Chairman of the Board of Civil Service Commissioners, being called upon said:

Mr. Chairman and gentlemen, when I had the honour to be Minister of the Interior, I always considered it a duty, as well as a great pleasure, to be present at your annual function, by reason of the fact that I was at the head of the Department which included the Surveyor General's Branch presided over by my trusty friend, that old war horse of the service, Dr. Deville. I was glad to bring myself in as close touch as possible with the personnel of the Department so that when any matter touching your service, individually or collectively, was brought to my attention, I might discharge my duty in regard to it, not only in an intelligent but in a sympathetic manner. I have too recently severed my relations with the Department to have lost interest either in your work or in your membership, and I am pleased indeed to see that my successor is in this matter, following in my footsteps. I am sure your annual convention must be productive of great benefit to you both individually and as a profession. The interchange of views cannot but widen your vision. Besides, I am sure that those of you who spend months of each year at the outskirts of civilization, subject to the difficulties and vicissitudes of that pioneer life, appreciate the change involved in coming to the Capital and engaging in conference with your fellow practicioners and taking part in social functions such as this. No matter in what occupation we may be engaged, it is necessary in these modern times to take every means to keep ourselves in touch with the progress of our profession. As education is necessary for the individual, so that nation will be most successful whose people are best trained with the affairs with which they deal. There are those—I hope they are very few—who imagine that when they graduate from college with a degree, their education is complete, but such organizations as yours are a recognition of the fact that true education is in keeping up with the progress of the world.

Canada has been looked upon in the past, and perhaps up to the present, as essentially an agricultural country. I have recently read—for I try to practise in this respect what I preach and have been reading in order to post myself in the duties of my new position—an American report of many years ago on the British Civil Service.. This, of course, was before Britain had the excellent Civil Service she has to-day. This report stated that the common idea was that the harum-scarum of the family should be sent to the army, but the fool of the family should be relegated to the Civil Service.. I have sometimes thought that a somewhat similar idea was acted upon in Canada in regard to agricultural life, that the farmer's son who showed more than average cleverness was sent to college to prepare himself for a profession, while he of ordinary intelligence was left on the farm. Of recent years it has been impressed upon our people how essential it is in order that we may compete with other producers throughout the world that our people who are to engage in agriculture should be trained academically as well as practically. The result is that in the agricultural colleges carried on by our provincial governments, not only the boys of the farm but the girls as well receive both theoretical and practical training to make their work on the farm more profitable and more pleasant as well. But it is not in agriculture alone that Canada excells. Time was when we considered it impossible to compete in manufacturing especially with our neighbors to the South with their vast natural resources, abundant capital and extensive home markets. But, thanks to the sagacity of our statesmen as well as to the industry and enterprise of our people, we can now point with pride to large manufacturing centres where great industrial populations are employed. In that connection I might refer to the technical schools under provincial and municipal direction in which the youth who intends to engage in occupations dealing with mechanical affairs can secure a training which will enable him to become thoroughly efficient. When the youth selects his life occupation, there is nothing like specializing as a means of proficiency. I am sure that it is upon that principle that your Association is established and your conventions are held—that those of your profession may keep abreast with the progress of the times.

My friend, the Minister of the Interior, has referred to the return of our soldiers. Many of these men are being trained in new occupations in the convalescent homes throughout Canada, for, as we realize with sadness, some will be unfitted to resume work in occupations in which they engaged before the war. I am glad to know, however, that in France it has been found that only one per cent. of those wounded are so disabled as to be unable to resume their avocation. With us, the percentage may be higher. In any case, as Mr. Meighen has said, here is a large problem to be solved. In connection with placing returned soldiers on the land, I had the pleasure of fathering the bill passed by Parliament to carry on that work. When the British Prime Minister and two of his colleagues asked to have a discussion of the land settlement policies of the Dominions, as it was desired, as far as possible, to retain British population within the Empire, I think I am right in saying that it is universally admitted that the plans decided upon by Canada were the most generous of the Dominions. I was pleased to hear Mr. Meighen express his sympathy with your aims in this work. I can speak more freely now than when I was Minister and when this matter was urged upon me by Mr. Magrath—I am sorry he is not present, but no doubt he has troubles of his own that keep him occupied elsewhere. You have volunteered your services in connection with the work of the Commission that has just been appointed. I certainly would back up your request; and I am glad indeed to hear Mr. Meighen accept it so sympathetically, because I am sure that the Commission could not do better in the discharge of the duties they will be called upon to perform than to avail themselves of the services of the Dominion Land Surveyors. I thank you for the courtesy extended to me in asking me to be here to-day, and I wish your Assoiation every success.

Dr. E. Deville, Surveyor General of Dominion Lands.—Mr. President and Gentlemen, it is most gratifying to have such sympathy and kindly feeling with our profession in Canada expressed by our Minister and Dr. Roche. Surveyors have been hard hit by the war, and they need sympathy. With the war they have seen their private practice go, and as to Government work, that has been cut down by hundreds of thousands of dollars. Instead of being in charge of parties a good many surveyors have had to take subordinate positions. We have managed in a way, to retain our organization so far, but on a very much reduced scale. It is to be hoped that it will not be reduced any further. The word has gone round, that we must exercise economy. Economy is certainly a patriotic duty at this time. But there is such a thing as mistaken economy—economy that does more harm than good. To illustrate this I would like to say a word about the history of our Dominion Lands surveys. When I took charge, in 1881, our surveys did not extend much beyond Manitoba—perhaps half a dozen townships were surveyed around Prince Albert. We were only starting and an organization had to be created. But you cannot create in a day or a year an organization great enough to deal with the immense amount of work we had to undertake. Still, the work was started, and in two years, that is in 1883, we did the largest amount of surveying we ever did when we sub-divided twenty-seven million acres. The organization kept perfecting itself with experience and direction, and in 1885 we had a very good organization indeed. But hard times struck us, and later on harder times still. The word went round then, just as it does to-day, that we were to save in all directions, that every expenditure that could be avoided should be dispensed with. Of course, I tried to carry out these instructions to the best of my ability and reduced expenditure to meet the circumstances. The result was that the organization which we had succeeded in creating vanished. That was unfortunate. I think it would be better if that organization had been kept in existence so as to be ready for the next big rush. You see, we made our surveys in two big pushes. There was that boom in the eighties when we were called upon to survey that great territory at once, then there was another push about 1898, when we were asked to start again a big program of surveys. But we had not the organization and so it had to be created again. An organization like ours is not a thing you can buy with money as soon as the need for it is felt—you cannot go and get it as you go to the grocer's and get a pound of sugar. It is the result of experience and tradition, and it takes years to build it up. If our organization is not kept alive, it will not be there when wanted, and, I think, that it will soon be needed more than ever. We will have new problems before us after the war, one of which I may mention as an instance. Statistics that are available show that in the western provinces there is as much land lying idle along and within twenty miles of the railways as there is under crop. And this at a time when we are short of food. Now, it cannot be imagined that this state of things is going to last forever. We are not going to starve when land is available for the production of the food we require. We have to make use of that land. But before we can make use of it a survey will be needed in order to find out what is the best way to make use of it—the most judicious use that can be made of that vacant land. That is one problem we have to solve; we have to make a survey of these lands; and the men to make a survey of the lands are the land surveyors—that is their profession. For these reasons, it seems to me, it is highly to be desired that the present organization be kept alive. The question of money, of course, is a very serious one, and we must save wherever it is possible to save. At the same time, we must not take too pessimistic a view of our position. To explain what I mean, let me mention something that many of you will remember, I suppose. Some thirty years ago Sir Richard Cartwright, who was at that time financial critic of the Opposition, was thundering in Parliament about the appalling expenditures of the Dominion under the Government in power, declaring that the country was going to ruin, that it could not stand the pace. Now what was the expenditure at that time? Thirty million dollars. It makes us smile to-day to remember that there was a time when a distinguished public man said that we were going to ruin because we were spending thirty millions a year. At present there are some who think that we are assuming an enormous burden financially. Yet, probably thirty years from now our children and grandchildren will smile to think that we were afraid of the burden we are at present undertaking. Of course, it is to be remembered that thirty million dollars years ago was something quite different from thirty million dollars to-day. Money has depreciated, there is no doubt about that. But there is something that does not depreciate, and that is the natural resources of Canada. And of all these resources, land is the most valuable. We must make the best use possible of our land and in order to make the best use of it we must have a complete survey of it.

The luncheon closed with the singing of the National Anthem.

SECOND DAY—AFTERNOON SESSION.

The meeting was called to order at 3 o'clock and the President at once called upon Mr. F. A. McDiarmid, B.A., to read a paper on "The Standards of the Geodetic Survey of Canada."

STANDARDS OF THE GEODETIC SURVEY OF CANADA.

F. A. McDIARMID, B.A.

Geodesy is the science of surveying extended to large tracts of country, having in view not only the production of a system of maps of very great accuracy, but the determination of the curvature of the surface of the earth and eventually of the figure and dimensions of the earth. This last, indeed, may be the sole object in view, as was the case in the operations conducted in Peru and in Lapland by the celebrated French astronomers, P. Bouguer, C. M. de la Candamine, A. C. Clarault and others; and the measurement of the meridian arc of France by Michain and Delambre had for its object the determination of the true length of the "metre" which was to be the legal standard of length of France.

The basis of every extensive survey is an accurate triangulation, and the operations of geodesy consist in the measurement by theodolites of the angles of the triangles, the measurement of one or more sides of these triangles on the ground, the determination by astronomical observations of the azimuth of the whole network of triangles, the determination of the actual positions of the same on the surface of the earth by observations, first for latitude at some of the stations, and second, for longitude and the determination of altitude for all the stations. It is essential that the azimuth and longitude observations be carried out at the same station, thus giving Laplace determination to control the twist of the triangulation.

For the computation, the points of the actual surface of the earth are imagined as projected along their plumb lines on the mathematical figure, which is given by the stationary sea-level and the extension of the sea through the continents by a surface of imaginary canals. For many purposes the mathematical surface is assumed to be a plane; in other cases a sphere of radius 6371 kilometres (20,900,000 ft.). In the case of extensive operations the surface must be considered as a compressed ellipsoid of rotation, whose minor axis coincides with the earth's axis and whose compression, flattening or ellipticity is about 1/298.

Measurement of Base Lines.—To determine by actual measurement on the ground the length of side of one of the triangles ("Base Line") wherefrom to deduce the length of all the other sides in the triangulation, is not the least difficult operation of a trigonometrical survey. When the problem is stated thus—to determine the number of times that a certain standard or unit of length is contained between two finely marked points on the surface of the earth at a distance some miles apart, so that the error of the result may be pronounced to lie between certain very narrow limits, then the question demands very serious consideration. The representation of the unit of length by means of the distance between two fine lines on the surface of a bar of metal at a certain temperature is never itself free from uncertain and probable error, owing to the difficulty of knowing at any moment the precise temperature of the bar; and the transference of this unit, or a multiple of it, to a measuring bar will be effected, not only with errors of observation, but with errors arising from uncertainty of temperature of both bars. If the measuring bar be not self-compensating for temperature, its expansion must be determined by very careful experiments. The thermometers required for this purpose must be very carefully studied, and their errors of division and index error determined.

In 1891 Mr. R. S. Woodward of the United States Coast and Geodetic Survey invented his "five-metre ice bar", and for determining the lengths of the field tapes or wires used in measuring base lines this five-metre ice bar has been used since then. The introduction of the ice bar apparatus did away with all uncertainty of temperature of the bars used as standards.. The length of the five-metre bar was determined from the standard metre bar which was secured by the U. S. Government in 1799, and which had been standardized by the French committee in terms of the toise, which had served as a standard unit in measuring the meridian arcs of France and Peru. The lengths of the chains or tapes used in measuring the bases in the field were determined from the length of this five-metre bar. A distance of 100 metres was first carefully measured with the five-metre ice bar, and then its length was determined with the tapes. The method of these comparisons will be explained later.

In November of 1899 the U. S. Government received three platinum-iridium bars of the prototype metre, standardized by the International Bureau at Paris, and from early in 1900 these have referred the Coast Survey standard to the International. The length of the iron metre bar was given in 1899 as 1m. - 0.4u, and from comparisons with the new bar, its length in 1900 was 1m. + 0.2u, +0. 6u, where u stands for micron, or the millionth part of a metre.

Probably a few words regarding these natural prototype bars may be of interest. In the year 1870 the Government of France invited the governments of the world to send delegates to Paris for the purpose of forming an International Commission, having for its object the construction of a new metre as an international standard of length. Owing to the unsettled political conditions then prevailing in Europe nothing was done until the second meeting in 1872, when a general plan was outlined and definite propositions as to the mode of procedure to attain the objects in view were adopted. The most important of these propositions was to make the International Metre a line measure, whose length at 0° C. should be equal to that of the Mètre des Archives, and to use as the material for the standards an alloy of platinum-iridium containing 10% of iridium, with a tolerance of 2% in excess or deficiency.

On May 20, 1875, a metric convention was signed at Paris by the representatives of seventeen nations for the purpose of establishing and maintaining, at the common expense, a scientific and permanent International Bureau of Weights and Measures near Paris. By this treaty, the operations of the International Bureau are put under the exclusive direction and supervision of an International Committee, which latter is under the control of a General Conference composed of delegates from all the contracting governments. This International Bureau of Weights and Measures is charged with :

(1) All comparisons and verifications of the new prototypes of the metre and kilogramme.

(2) The custody of the International Prototypes.

(3) The periodical comparison of the National Standards with the International Prototypes, and with their test copies, as well as the comparison of Standard thermometers.

After much experimenting and investigation an alloy was produced from which some thirty-one bars were made. The length of one of these at 0° C. was found equal to that of the Mètre des Archives, and it was selected as the International Prototype. The other bars distributed to the different governments are called National Prototypes and their lengths are obtained with the greatest degree of accuracy obtainable. The probable error of the comparison of these National bars with the International metre is $\pm$.04u.

As pointed out above the U.S. Government has three of these National Prototypes, two of them being known as Nos. 27 and 21. Some doubt as to whether there was any change in their lengths arose, and in 1901, No. 27 was again compared with the International Bar. The length in 1888 for No. 27 was 1m. - 1.55u at 0° C.

In 1901 the length of No. 27 was 1m. - 2.00u at 0° C., or there was an apparent shortening of 0.45u. It is not the intention to discuss this apparent discrepancy. It is not vital to this paper.

Standards of the Geodetic Survey of Canada.—The standard of the Geodetic Survey of Canada is a nickel bar known as No. 10239. Its length was determined by R. T. Glazebrook of the National Physical Laboratory of Teddington, England, in 1913. Mr. Glazebrook compared it with the British National Prototype metre. He also determined the coefficient of expansion of the Canadian bar. Its length at 0° C. is 1.000.026,9 metres and its length at any temperature, say t° C. is given by L = L° (1 + 0.000,012,53t+0.000,000,005,21t20) t being expressed in the hydrogen scale. But as this bar is never used except at 0° C. the only concern is with the length at that temperature, namely 1.000-0269m.

The Standard Nickel Bar No. 10239 is of H form cross section and total length of 102.6 cm. length of side is about 2.5 cm.

The graduations are on the neutral plane of the bar and are at each millimetre from 0 to 100cm. A millimetre scale divided into tenths is added immediately beyond each end of the fundamental distance 0 - 100 cms.

The auxiliary standard of the Geodetic Survey of Canada is a five-metre steel bar obtained from Washington in 1906. Its length as given by the United States Bureau of Standards was 4.9999464 metres. Since that time its length has frequently been determined from the standard nickel bar, and there seems to be no sensible change in its length. Its length at the different determinations since 1908 are shown in column 2 of the accompanying table No. 1.

In no case is the difference of any determination from the mean of all larger that one in a million. One would expect slight differences in its length from different observations owing to errors of alignment. The quantities being measured are so small that a slight deviation in lining the five-metre bar would produce an error quite measurable. But if the five-metre bar is not changed in position between times of its comparison with the metre standard and with the tapes, then no error will appear in the tape results.

Before describing the method of comparison of the five-metre steel bar and the standard nickel bar, probably a short description of the Standards building itself will be in order. The building, one storey in height, sits approximately north and south, and is built of heavy stone blocks. The floor is of concrete, and down the centre of the building lies the fifty-metre comparator base. This fifty-metre base is divided into ten equal parts by eleven concrete piers,.one pier at each end of the base, and nine at equal intervals of five metres each. These piers are built entirely separate from the floor, and rest on large foundations, and are free from all vibration. The tops of the piers are covered with cast iron plates with attachments for mounting and adjusting microscopes for observing the end graduations of standards and for determining the length of the fifty-metre base or comparator with the five-metre auxiliary standard bar. The microscopes are so mounted and adjusted that the length of the five-metre bar may be multipled ten times and the exact length of the fifty-metre base may be determined in terms of the five-metre bar.

The ends of the fifty-metre base or comparator as it is generally called, are marked by bronze bolts set in concrete blocks. Each bolt terminates in a spherical head, and the centre of this bolt head is the fiducial point. To refer to this point a cylinder called a cut-off cylinder is used. It terminates at one end with a conical hole which fits over the spherical head. The other end is fitted with a transverse level and graduated scale. The scale is brought by a rack and pinion motion under the microscope whose position relative to the fiducial point is sought. The scale and level, which are parallel to each other, are placed parallel to the line measured. With the cylinder thus disposed readings of the micrometer on the scale and of the position of the level bubbles are made. The cylinder is then turned 180° in azimuth and the scale and level readings are again observed. From these observations and the height of the scale above the bolt head, the horizontal distance (in the direction of the line) between the micrometer zero and the fiducial point may be determined.

The five-metre section at the north end of the comparator is divided into five equal parts by concrete piers, on which are provided plates and microscopes. Through this means the length of the five-metre bar is determined from the standard nickel bar.

Five-Metre Bar.—The five-metre bar is a rectangular bar of tire steel. It is 5.02m. long, 8mm. thick and 32mm. deep. The upper half is cut away for about 2cm. at either end to receive the graduation plugs of platinum-iridium, which are inserted so that their upper surfaces lie in the neutral surface of the bar. Three lines are ruled on each of these plugs, two in the direction of and one transverse to the length of the bar. To secure alignment of the bar, eleven German silver plugs of 5mm. diameter are inserted at intervals of 495mm. along the bar, so that they project 1mm. above its top surface.

Ice Trough—When comparing the two bars, the standard nickel bar and the five-metre steel bar, both bars are packed in a solution of ice and water. A few words about the troughs in which they are mounted will be in order.

The five-metre bar is placed in a Y shaped trough. This trough supports the bar, keeps it aligned and carries the load of ice and water essential to control the bar's temperature. The sides of the trough, which are of steel plates and bent to form an angle of 60° are riveted together. The bar is supported at every half metre of its length by saddles which are rigidly attached to the sides of the trough by screws. Each saddle carries one vertical and two lateral adjusting screws. These screws serve to fix the alignment of the bar. The lateral adjusting screws of the saddles at the ends of the bar are of the same height. The lateral adjusting screws of the intermediate saddles are alternately high and low. The object of this disposition is: first, to prevent pinching the bar, which might occur if the screws were all opposite to one another; second, to afford means of rotating the bar slightly about its longitudinal axis, so that for a fixed and nearly vertical position of the trough the graduated surfaces of the bar may be made horizontal. The vertical adjusting screws of the saddles project below the vertex of the trough.

The trough is very rigid with respect to vertical stresses, and is covered with a closely fitting jacket of heavy padded cotton, which protects the bar and load from direct radiation.

For measuring grade angles a sector reading by two opposite verniers is attached to one side of the trough near its middle point.

The Y trough is mounted on two cars, the saddles of which are attached to the trough 40cm. from either end, and which are provided with an adjustment, laterally, longitudinally and vertically for centering and focusing the ends of the bar under the microscopes.

When the apparatus is in use the trough is filled with ice and water. Brass tubes with suitable rubber washers are adjusted over the end graduations of both the five-metre and one-metre bars. Both bars can thus be completely covered with ice and water.

..**Adjustment of Bars, and Determination of Five-Metre Bar.**— The five-metre bar is first placed in alignment by means of a fine thread run from end to end of the trough. The centres of the tops of the plugs in the top of the bar are placed directly under the thread. The bar is adjusted in a horizontal plane by means of a striding level which reaches from any one plug to the third, a distance of 999mm.

The grade sector of the apparatus is adjusted to zero when the graduated surfaces of the bar are in the same horizontal plane.

The one-metre nickel bar is mounted in a wooden box which sits in the top of the Y trough of the five-metre bar near the north end of the trough. The neutral horizontal plane of the metre bar is made parallel to the neutral plane of the five-metre bar. It is also placed in the same vertical plane.

After having both bars carefully adjusted, it is absolutely necessary that both be at 0° C. The experience of the speaker has shown that the bars must be in the solution of ice and water at least forty-eight hours before it is safe to commence observations. When both bars have reached 0° C. the trough is placed under the microscopes. The microscope on the south pier of the five-metre bar is set at some arbitrary setting. The graduation at the south end of the five-metre bar is then, by means of the levers and adjusting screws brought to be covered by the wires in the microscope. The north end of the bar is then brought into adjustment with the north microscope. When both ends are perfectly adjusted the cars carrying the trough are clamped to the rails. Simultaneously an observer at either microscope reads the graduations and the readings of the micrometer are recorded. Five such readings are taken and the observers change ends and five other readings are taken. In this way any personal errors will be eliminated. The mean of the ten readings on either end will be the positions of the zeros of the microscopes with relation to the five-metre bar. The level on the sector is adjusted and verniers read. One such set of readings will give the distance between the zeros of the two microscopes in terms of one length of the five-metre bar, the micrometer readings and the sector readings. The trough is then lowered and the south end of the one-metre bar is brought under the south microscope, and the north end of the bar is adjusted with respect to the microscope on the next pier. Ten readings are taken on the one-metre bar following the same programme as with the five-metre bar. Then the car is moved one space north and the south end of the one-metre bar is brought to read in the second microscope at nearly the mean of the previous ten readings on the north end of the bar. Thus space two is measured. This process is repeated until the whole five spaces are occupied. Thus the distance between the microscopes on the south end of the five-metre space and those on the north end of that space is determined in terms of five lengths of the one-metre bar, the small differences of readings of the intermediate microscopes, and the sector readings on the various spaces. By comparing these observations on the two bars the length of the five-metre bar is found in terms of the standard nickel bar. Usually to obtain the required degree of accuracy about twelve sets of observations are made.

Determination of Length of Fifty-metre Comparator.—The operation of measurement of the length of the comparator proceeds as follows: The position of the microscope relatively to the fiducial point at one end, say the south end of the line having been observed, the trough carrying the five-metre bar is brought under the microscopes, and the south end of the bar is brought to focus under that end by one of the observers. By means of a lever the south end observer holds the bar near to bisection under the microscope while the first or north observer brings his microscope into position over the north end of the bar, to do which he must make use of the lateral motion of the trough. When the bar is adjusted at both ends the south observer brings the south end graduation accurately to bisection between the micrometer wires by use of his lever without turning the micrometer screw. Simultaneously he gives the signal "point" to the north end observer who brings his micrometer wire to bisect the north end graduation by moving the micrometer wire. The observers then read their micrometers and the recorder notes the readings. The observers interchange positions and repeat the operation. The north microscope is then set at the mean of the two readings on the north end of the bar, the bar is moved on to the next space, and so the legnth of comparator is found in terms of the length of the five-meter bar and the readings of the two end micrometers. The grade sector is read on each space and if necessary a correction is applied to the results. The values of the two micrometer screws are accurately known, and hence the length of the comparator is obtained. The various determinations of length of the comparator as obtained in May of 1917 are shown in Table II.

Determination of Length of Reference Tapes.—There are five tapes belonging to the Geodetic Survey of Canada which are used in connection with the determination of the lengths of the base lines. Two of them, Nos. 4252 and 13814 are known as reference tapes. They are used only in the Standards Building. Their lengths are determined from comparisons with the length of the comparator. The other three tapes, Nos. 3139, 3140 and 3141 are used on the base lines. Their lengths are determined from comparisons with the length of the reference tape No. 4252.

All these tapes are made of invar, an alloy which has a very small coefficient of expansion. The tapes are used in the Standards Building under nearly the same conditions as in the field.

In order to obtain the exact temperature of the tape, thermometers are fixed to the eleven piers, and hang within a few inches of the tape under observation. The thermometers are read frequently. The tapes fifty metres long are swung under a tension of 15 kilogrammes over pulleys at each end, and are supported at the centre by a "race". The "race" is practically frictionless.

The following procedure is carried out in standardizing the reference tape No. 4252. The zeros of the microscopes are determined with reference to the fiducial points on the head of the bolt marking the ends of comparator. The length of the comparator is determined from south to north as described above, the trough carrying the ice bar is removed from the cars which are dismantled, and the "race" is placed in position for the tape. The reference tape No. 4252 which along with the other four tapes is hanging from the ceiling of the building is taken down and placed in its position under the microscopes. Small wooden blocks sit in the top of the cut-off, and the cut-off tube is so adjusted that when the tape just clears these blocks, the graduations on the tapes are in focus in the microscopes. The graduations on the tapes do not run entirely across the tapes, but only part way. The observations are always made on the end of the graduation at the edge of the tape. When the tape is in place, and adjusted the following method of observation is employed. One of the observers moves the tape, or say "pushes" the tape. When he is ready, he calls "ready" to the observer at the other end of the tape. At this signal the second observer by a slight pressure of the finger brings the tape to rest and on the signal "point" both observers set their micrometer wires on the graduations. The micrometer readings are made and recorded. Five such settings are made, and the observers change ends, reading the thermometers as they travel from end to end of the comparator. For the second five readings the observer who is handling the tape instead of "pushing" the tape, now "pulls" it, and five other readings are taken. The mean of ten sets of the differences of the micrometer readings will give the difference between the length of the tape at the observed temperature and the legnth of the comparator. The weights are then taken off the tape and the tension released and again put on. Six sets of such readings are taken on the tape, before it is again hung in its place on the ceiling. Then the length of the comparator is again determined with the five-metre ice bar going from north to south. For a complete determination of the length of a reference tape four such groups should be taken, i.e. length of comparator four times forward and back, and six readings on the tape between each pair of journeys of the bar. In this manner twenty-four determinations of the tape will be obtained. The length of reference tape No. 4252 as determined is shown in table No. 3.

Comparison of Field Tapes with Reference Tapes.—When observing with tapes in the field, it is necessary to know the temperature of the tapes. For this purpose two thermometers are clamped to the tape, one near each end. Of course in standardizing the field tapes these thermometers are always placed on the tapes. The following procedure is carried out in comparing the field tapes with the reference tapes. The "cut-off" is first read, and then the reference tape No. 4252 is placed under the microscopes and a set of readings made as above described. The thermometers are read and the tape removed, and replaced by one of the field tapes, say No. 3139. The two thermometers used in the field are fixed to the tape and a set of readings are taken on this tape. It is removed, and replaced in turn by the second field tape No. 3140. This operation is repeated on the other tapes Nos. 3141 and the second reference tape No. 13814, and finally the first reference tape No. 4252 is again observed. Or a complete set on the tape consists of observations on the tapes in the following order, Nos. 4252, 3139, 3140, 3141, 13814 and 4252 a second time. The length of the comparator is obtained from the length of No. 4252, and the lengths of Nos. 3139, 3140, 3141 and 13814 are obtained from the determined length of the comparator. It will be noticed that all personal errors of the observers are eliminated by the exchanging of ends at each half set, and any errors of pressure due to "pulling" or "pushing" the tapes will be thrown out, by the observer pushing for one half set and pulling the next half set. If possible, the observer who does the pulling and pushing should be the one who moves the tapes in the base observations. Then the tape will be handled under exactly similar conditions to that employed on the base.

In concluding this brief account of the standards of the Geodetic Survey of Canada, the speaker would like to point out the fact that the methods that are here described are the methods in use in all the leading Geodetic Surveys of the world, Paris, London and Washington, etc. The standardized nickel bar is the base from which all the measures are made. From the one-metre bar, the length of the five-metre bar, and from the five-metre bar the tapes.

It will be interesting to note the check between the values of the five-metre bar as given by Washington and the lengths as obtained from the one-metre standard. The five-metre bar is of steel, a metal which experience has shown is very constant under varying conditions of temperature. The length as given by Washington was 4.9999464 metres. The mean of the lengths for the several observations at Ottawa gives 4.9999486, a difference of about one in two and one-quarter millions.

There are quite large changes in the length of the tape lines from time to time. Professor R. T. Glazebrook of Teddington in speaking of invar tapes says, "We have not found any tape yet that has changed at a regular rate. All these tapes or wires used for base measurements are very delicate and are liable to changes in length due to some treatment to which they may have been submitted, and this usually altogether outweighs any change that may result from regular molecular alteration. For instance, slight jars in handling may result in molecular changes, or even in small kinks or twists in the tape, which may be accompanied by alterations in length."

Professor Glazebrook also strongly recommends that tapes used in measuring Geodetic Base lines should be compared with the standards before, during and after the measuring of the base. This seems the only method to pursue if the work is to have the required degree of accuracy. The errors coming from outside sources, as injury to tapes, are likely to be far larger than any errors of observation.

TABLE NO. I.

Length of 5-Metre Bar at 0.°C and Tapes at 16.05C from Standard Nickel Bar 10239.

TABLE NO. I.

Length of 5-Metre Bar at 0°.C and Tapes at 16.05C from Standard Nickel Bar 10239

Date	5-Metre bar	Tape 4252	Tape 3139	Tape 3140	Tape 3141	Tape13814
	Metres	Metres	Metres	Metres	Metres	Metres
1908	4.9999464					
July 1914 ..	4.9999503	50.000382	49.999525	50.000004	50.000510	50.000067
Dec. 1914	4.9999489	50.000415	49.999593	50.000119	50.000600	50.000118
June 1915 .	4.9999507	50.000446	49.999612	50.000154	50.000615	50.000231
Nov. 1915 ..	4.9999432	50.000393	49.999612	50.000142	50.000579	50.000211
May 1917 ..	4.9999490	50.000604	49.999754	50.000306	50.000730	50.000460
Sept. 1917 ..	4.9999499	50.000569	49.999683	50.000204	50.000618	50.000394
Nov. 1917 ..		50.000580	49.999642	50.000221	50.000596	50.000464

TABLE NO. II.

Length of Comparator.

Date	Reference	Tem.	Length in Metres
1917		c	
April 25	Tape 4252	7°0	50.000,746
" 26	"	6°0	50.000,763
" 30	"	10°0	50.000,842
May 1	"	8°5	50.000,844
" 2	"	7°5	50.000,824
" 3	"	7°0	50.000,821
" 4	"	7°5	50.000,797
" 9	5 Met. bar	12°1	50.000,902
" 10	"	11°85	50.000,892
" 11	"	9°9	50.000,868

TABLE NO. III.

Length of Tapes 4252 and 3141 from 5-Metre Bar

Date	Tape 4252	V	Tape 3141	V
1917	Metres		Metres	
May 9	50.000,596	8	50.000,722	+ 7
"	587	17	713	16
"	616	—12	725	04
"	576	28	745	—16
"	588	16	690	39
"	601	03	731	—02
"	638	—34	776	—47
May 10	50.000,629	—25	763	—34
"	651	—47	732	—03
"	669	—65	737	—08
"	607	—03	755	—26
"	636	—32	676	53
"	566	38	663	66
"	562	42	723	06
"	588	16		
May 11	50.000,619	—15	718	11
"	632	—28	744	—15
"	583	21	766	—37
"	581	24	705	24
"	600	04	731	—02
"	618	—14	746	—17
"	586	18	727	02
"	556	48	743	—14
Mean	50.000,604		50.000,729	

TABLE NO. IV.

Length of 5-Metre Bar from Standard Nickel Bar No. 10239

Date	Length in Metres	Date	Length in Metres
1917			
May 16	4.9999,460	1917	
	410	Sept. 27	4.9999,494
	539		450
	519		504
	504	Sept. 28	558
	494		525
			549
			489
May 18	4.9999,509		443
	491		497
	507	Sept 29	467
	457		435
	502		475
Mean	4.9999,490	Mean	4.9999,499

The President.—We are greatly indebted to Mr. McDiarmid for his paper, and we would like to hear some discussion on it.

Mr. Norrish.—I notice that there is an appreciable change in the length of the comparator from day to day. Is there any noticeable change in the course of the observation, and is any allowance made for that ?

Mr. McDiarmid—Our method is this : We determine the length of our comparator, say in the morning at nine o'clock. After the tapes are put through, the length of the comparator is again determined by means of the five-metre bar. We take the mean of these two observations and apply that to our tape readings. We take another set in the afternoon in the same way. Thus, as far as possible, any difference in the length of our comparator is eliminated.

Mr. Seymour.—I would like to ask Mr. McDiarmid how the coefficients of expansion of the tapes are determined for calculating the lengths of the tapes at any other temperature than that at which they are standardized ?

Mr. McDiarmid.—The coefficients of expansion of these five tapes have been determined four times, twice in Washington and twice in London.

A Member.—What length of the time is covered by the observation to get the length of the five-metre bar compared to the one-metre bar ?

Mr. McDiarmid.—We generally spend two days in comparing the five-metre bar and the metre bar. The main thing is to get the microscopes and the lights right. With everything ready it takes about fifteen to twenty minutes to make one set of observations comparing the metre bar to the five-metre bar. Then, it takes twenty to twenty-five minutes to determine the length of the comparator with the five-metre bar. A morning's work will give us two determinations of the length of our comparator with the five-metre bar and six comparisons of our tape. Once the bars are down to zero, I will undertake to standardize three field tapes in six days, giving eighteen to twenty determinations of each tape.

Mr. Rannie.—Is the alignment of the five-metre bar as it travels from end to end of the comparator dependent on the alignment of the track ?

Mr. McDiarmid.—I am glad to be asked that, as it helps me to clear up points which I may not have fully explained. The microscopes are brought into line by means either of a transit or of a cord stretched tightly from one end of the building to the other over the centre of the end microscopes. The track may be appreciably out of alignment but we bring the bar under the microscopes which are placed absolutely in line as I explained in my paper.

Mr. Rannie.—I was not quite clear about the function of that sector. Is that merely to show as you go along, whether the bar is still level ?

Mr. McDiarmid.—Yes. If it is out of level the sector measures how much.

Mr. Rannie.—Is the level bubble attached to the sector like the level bubble of the vertical circle of a transit ?

Mr. McDiarmid.—Exactly.

Mr. Rannie.—What is the probable error in the standardization of field tapes ?

Mr. McDiarmid.—As I showed in the slides the probable error is 11 microns, that is, 1 in 5,000,000.

Mr. Henderson.—We read that there is a copy in Canada of the official yard of Britain. Mr. McDiarmid refers to a metre bar kept, I think, in France. What is the connection between the two ? The measurements, Mr. McDiarmid has demonstrated to us are very accurate, but I do not know what connection they have with the legal standards of this country.

Mr. McDiarmid.—I do not know that I can wholly explain that point. An international convention held in Paris in 1875 appointed a committee representative of all the leading nations, including Britain, and that Commission adopted the metre as the measure of length. The yard is another standard of length which, of course, is legalized in Britain and in the United States as well. Two or three copies of the standard yard of Britain were sent to the United States as others were sent to Canada. But when comparisons were made of the copies sent to the United States with the original, considerable change was found to have taken place. Of the three copies received by the Canadian Government two have been destroyed in the Parliament Buildings fire. It has been found that there is less variability in the material of which the standard metre is composed. The English standard yard contains a large percentage of copper, a metal that is very rigid but also very ductile.

Mr. Henderson.—Suppose the question were to come up in court, of the actual distance between two points, would your measurements be taken or would some other standard have to be sought ?

Mr. McDiarmid.—We have the relative length of the metre and the yard, and that being so I do not see why our measurement should not be accepted. I expected this question to come up but I confess the point is one on which I am not quite clear. Perhaps Mr. Dodge could throw light upon it. But I believe that if the surveyors here were to impress upon the Government the fact that we do need in Canada some standard of length—

whether we use the metre or the yard as the basis, this point could be cleared up.

Mr. Dodge.—Two or three years ago the international metre was legalized in Canada so that measurements on that basis are quite legal. The difficulty arises when any attempt is made to give the metre a relation to the British standard of length, the yard or foot. So far as the law is concerned, our standard yard is still the bar deposited with the Inland Revenue Department.

Mr. Henderson.—Is there any comparison between that yard and the Imperial yard ?

Mr. Dodge.—No. But there is a comparison of the Imperial yard with the international metre, and the international metre is a legal standard in Canada.

The President.—Are we to infer that all former surveys have been illegally done ?

Mr. Dodge.—In what way ?—when we give the length in metres or when we give it in feet ?

The President.—When we give it in chains.

Mr. Dodge.—In that case the standard of length is the Canadian yard.

The President.—Then the surveys are illegal.

Mr. Dodge.—I would not say that, but it seems to me that there is a range of doubt as to the true legal lengths. As Mr. McDiarmid has said, it has been proved beyond doubt that the bronze standards change in length.

The President.—But they are the legal standards ?

Mr. Dodge.—Yes, not only in Canada but also in Great Britain.

Mr. Norrish.—Will Mr. Dodge say that even our land measurements are dependent upon the relation between the international metre and the yard ?

Mr. Dodge.—The standard for our land measurements still remains the Canadian yard. What is used in the Surveys Branch as the standard is the international metre. Our trouble is—it does not affect the Geodetic Survey to the same extent—that the relation between the Canadian yard and the international metre has not been established.

The President.—An act of Parliament could remedy all that.

Mr. Dodge.—Yes. There are different ways of doing it. One way would be to make the international metre systems of measures standard for both and another way would be to establish the relation between the Canadian yard and the international metre.

Mr. Barber.—It seems to me a very necessary thing that either the metre should be made the official standard for both or that there should be an official comparison between the Canadian yard and the international metre.

The President.—The Canadian yard is evidently so variable.

Mr. Barber.—Yes, and that may be a reason why it would be better to make the international metre the standard for both. I would like to know if there has ever been a definite agitation to have this done.

Mr. Dodge.—None, so far as I know.

Mr. Barber.—Do you not think it would be well if we started one ?

Mr. Dodge.—If the matter were brought to the attention of the authorities in the proper way I think it could be settled without difficulty. Now that two of the Canadian standard copies have been destroyed, I suppose they will order others, and before that is done would be a good time to take up the matter. We might urge a platinum iridium in place of a bronze standard, and we might also bring up the question of the relation of the yard to the metre. The conversion tables are based on the length of the Imperial yard; it is assumed in these tables that the Canadian yard is the same as the Imperial yard. I suppose it may be argued that so long as the Inland Revenue Department do not question the standard used on our surveys the Topographical Surveys Branch does not need to care, but the fact remains nevertheless that the point can be raised at any time.

The President.—In a land case a lawyer might take an appeal against a court decision on the ground that the survey did not conform to the legal standard.

Mr. Dodge.—In an ordinary land case the difference would be immaterial.

The President.—Not a material difference but it might be an important one from a legal point of view.

Mr. Dodge.—I think that if the interested parties in this matter were to get together and appoint a committee something could be done. For instance, the Surveyor General as head of the Topographical Surveys Branch, the head of the Geodetic Survey, the President of this Association and others might bring matters to the notice of the Minister of Inland Revenue.

Mr. Fawcett.—When you and I became surveyors, Mr. President, each of us was provided with a standard of measure which overcame this whole difficulty. There were no surveys in those days whose standards were illegal. The standard measure for Ontario was a copy of the yard stamped by the Inland Revenue Department: one yard; three feet, and on the other side five links. Every surveyor was supposed at the beginning of every important survey, to compare his tape with this standard.

The President.—A wooden one, was it not?

Mr. Fawcett.—Yes, with brass straps on it. The Secretary of the Board of Examiners had a five-link measure provided by the Inland Revenue Department with which he compared the standards of the surveyor.

The President.—And charged a dollar a trip.

Mr. Fawcett.—Yes. And, having these standards, we made surveys that were legal, while these others, it appears, may be challenged in the courts. (Laughter.)

Dr. Klotz.—If the D.L.S. Association ever has an archives department, as I hope it will some day, I shall have great pleasure in presenting to it one of the standards of which Mr. Fawcett has spoken. I think I recollect that the representative of the Department of Inland Revenue marked the ends with a scratch-awl. As to standards, of course, there can be only such standards as are made by act of Parliament. The conversion factors that have been spoken of, of course, cannot amount to anything for scientific calculation, as they are only approximate. Time and again it has been suggested that we should abandon a material standard and take light as our basis, setting our standard in terms of wave length. But, whatever our standard, it can only be made so by act of Parliament, of course. I am strongly in favour of the metric system. Some years ago we had a very strong advocate of that system in Sir Henri Joly Lotbinière, who was Minister of Inland Revenue. He travelled throughout Canada and gave lectures on the subject and otherwise agitated for the change. The metre is now a legal measure, but it is not compulsory. When chaos gives way to order in the world I hope that Great Britain and the United States will adopt the metre as the one standard.

Mr. Dodge.—There is one point which Mr. Klotz possibly did not bring out, and that is that since 1893, the American yard is legally defined as being some definite established part of the international metre, this relation being 3600/3937. In order to place the Canadian standards of length on a satisfactory basis we might suggest one of three courses to the Inland Revenue Department.

First, an act making the metre the sole standard in Canada, or in other words making the metric system compulsory in Canada. While I believe that a large number, perhaps all of us here, feel that the metric system is the ideal system, it cannot be disputed that the change would be a very radical one and would meet with very strong opposition, so much so that I am satisfied no government would entertain the proposition, at the present time.

Second, an act establishing the Canadian yard as some definite part of the international metre, either that established in the United States for the American yard (3600/3937) when the yard would be the same everywhere in America, or the relation found between the Imperial yard and international metre. As I understand that the fundamental principle underlying the Canadian standards is that they shall be identical with the British Standards, this latter alternative would probably be more acceptable and as nothing radical is involved would I believe meet with little opposition.

Third, the purchase of a platinum iridium yard which would either by Order in Council, or if this is not sufficient, by Act of Parliament, replace the Canadian yards destroyed in the Parliament buildings fire and be considered the standard Canadian yard, and the determination either by direct or indirect comparison of this yard with the international metre.

Mr. Henderson moved, seconded by Mr. Tobey, that a committee be appointed by this Association to consider the question of the standard measure of Canada and to seek for the co-operation of other scientific bodies in the solution of this question.

The motion was agreed to.

Mr. Rannie moved, seconded by Mr. Barber, that Messrs. Dodge and Tobey be apponted a committee for the purposes of the resolution just carried with power to add to their numbers.

The resolution was carried.

Mr. Shanks.—We were surprised and pained to read in this morning's paper of the death of Mr. Martial Cote, the father of one of our members, the gentleman who appeared before the Association yesterday, to demonstrate his appliance for the correct location of pits. I think it would be proper that the Secretary should be instructed to send a letter of sympathy to Mr. Cote on his loss. If it is thought better to put that in the form of a motion I desire my remarks to be taken in that way.

The resolution was seconded by Mr. Barber and carried.

Attention having been called by one member to the fact that through the courtesy of Fire-chief Graham tarpauling had been placed over the skylights and windows of the room to darken it so as to make possible the use of the lantern, it was moved by Mr. Seymour, seconded by Mr. Barber, that the Secretary be instructed to write to the Fire-Chief conveying the thanks of the Association.

The resolution was carried.

The Association adjourned until 8 o'clock.

SECOND DAY—EVENING SESSION

The meeting was resumed at 8 o'clock with Mr. T. Shanks, Vice-President, in the chair.

The Chairman.—Our President is unable to be here to-night and has asked me to take his place. I welcome to our meetings those who are not members of our Association, especially the ladies who show their interest in our work and who grace our meeting with their presence. The subject for to-night is photography. Photography may be said to cover three fields of activity. One is the artistic, used chiefly in the production of portraits and landscapes and made familiar to us even in our early days in the works of art treasured in the family album, which still survives in places where the simple life has not given way to the more luxurious views of modern civilization. The second use of photography is that made still more familiar to us in the field of entertainment. Even if you have not attended the movies you can recognize the importance of an art that has relegated Shakespeare to the background and has made the classic drama an almost forgotten memory. But the third and most important phase of photography is that to be brought before you to-night, the economic or industrial,—the photography of the workshop, in contradistinction to that of the studio or the theatre. So much for the subject. The speaker of the evening is Mr. H. K. Carruthers, an expert in his particular line of photographic work, that of map production. It is only fair to say that the man who has made Mr. Carruthers' work possible and under whose fostering care that work has been developed, is Dr. Deville, Surveyor General of Dominion Lands. Dr. Deville is too modest to blow his own horn, and, I know, will not thank me for this public reference to his work. But we who happen to know the facts recognize that, owing in no small part to the attention he has given to it, this Branch of the photographic art has ceased to be a mere plaything and has become a very important factor in practical work.

Mr. H. K. Carruthers delivered an address on Map Reproduction as follows:

MAP REPRODUCTION.

BY H. K. CARRUTHERS, CHIEF PHOTOGRAPHER OF THE TOPOGRAPHICAL SURVEYS BRANCH.

(Department of the Interior.)

The title of this paper to-night should read "Map Reproduction by Photozincography", to distinguish it from the various methods in use to-day.

The engraving and printing of maps is quite an industry, employing a large number of skilled men at very high wages.

The sums spent annually by both Federal and Provincial Governments are enormous, to say nothing of the railroads, steamship companies and motor touring bureaus.

The more expensive and intricate maps are engraved on stone or copper.

For the last twelve years I have made a special study of map reproduction and I believe we have perfected a process equal, and, by some experts, thought superior, to copper-plate engraving.

I particularly mention copper-plate engraving, because it ranks as the highest standard in map reproduction.

In dealing with this subject to-night it is not my intention to delve too deeply into its early history, or to enumerate the dozen and one different processes, but to confine myself entirely to present day methods.

The sudden onslaught on Belgium by Germany in 1914 caught that country so unawares that it was almost like an earthquake. Many of its towns and villages were ransacked and their valuables carried off. We are told that among the treasures confiscated by this war frenzied country, was the whole mapping equipment, leaving military Belgium sadly handicapped in this respect. Fortunately, England and France possessed proofs of these stolen plates and were able to re-photograph them in a short time.

The French maps—one of which I will show this evening—are a work of art and most up-to-date in every detail. In the early part of the war, when Paris was threatened, France, benefitting by Belgium's mishap, had her whole mapping division moved to safety.

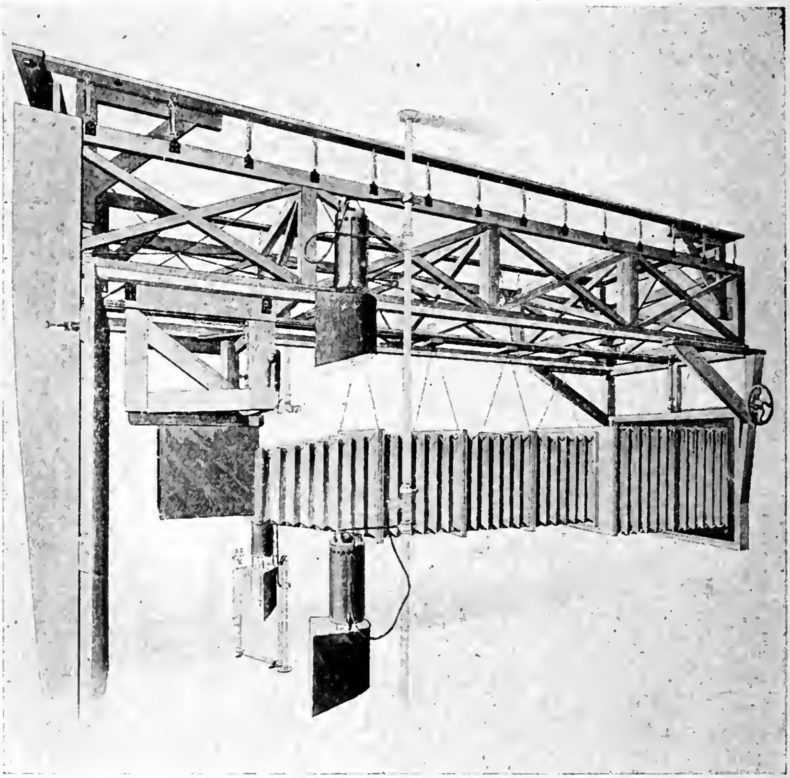
Maps are to-day almost as necessary to a combatant nation as ammunition. On the Western Front a system is in operation whereby attacking parties are supplied with maps showing in detail the country lying in front.

Airships are equipped with special cameras for photographing the enemy's territory. When a Hun battery is discovered a photograph is taken and a plan drawn and printed from a portable printing outfit.

A party of American Generals were being shown over a portion of the British front in France. They were handed a copy of one of these field maps and their attention drawn to a particular spot appearing on the plan. They were informed that at 20 minutes to 3 o'clock, 70 British guns would each drop a shell in the vicinity of that spot. These generals heard the roar of the 70 guns and next morning were shown a fresh plan with the spot missing. No doubt the scale on that plan gave the gunners the correct range.

Previous to 1900 the majority of maps published by the Dominion were engraved on stone. About that time a Toronto firm imported from England a number of copper plate engravers. I believe it was Mr. James White, then Chief Geographer, now Assistant Chairman, Commission of Conservation, and one of the greatest authorities on the production of maps, who was largely responsible for the change.

One great drawback to stone engraving was the necessary changes made from year to year which could not be done to advantage owing to the scraping away of the stone's surface, whereas in copper-plate engraving all that is necessary is to



CUT NO. 1

hammer, or punch up from the back, repolish that portion of the plate and re-engrave. Single stones on which maps were engraved cost approximately $1000 each, while a copper-plate to accommodate the same size cost about $20.00.

Copy for the map, i.e. the sketch supplied the engravers to follow is generally drawn to a much larger scale than will appear in the finished engraving. This permits of more latitude in the compiling and is a big advantage in the draughting department.

It is not my intention to explain the copper and stone processes, but to illustrate the latest and most economical process, that of photography. For this process it was necessary, from the Surveyor General's point of view, to construct a camera of special design, one that would produce the maximum amount of accuracy with a minimum of distortion.

While I am first going to illustrate and explain this new camera, it will be followed by the commercial style commonly used and from which you can draw your own conclusions.

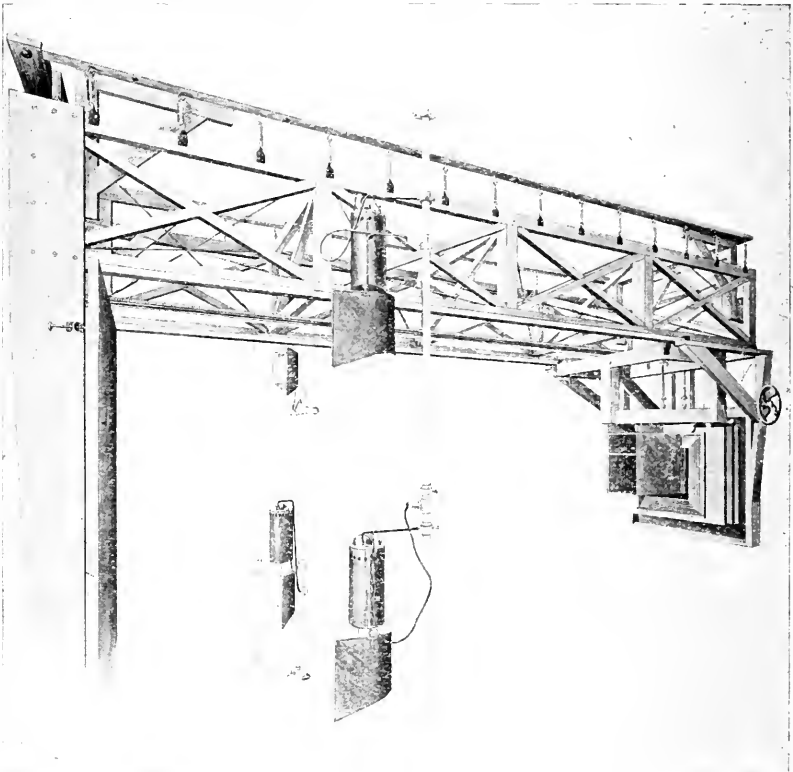
A word about the theoretic and mathematical side will prepare those who are not familiar with the metric system.

The metric system is used throughout in arriving at the different settings and for focusing. A millimeter scale forms part of the board and a millimeter scale extends along the entire length of the camera. A millimeter is 1/25.4th of an inch. We go further than this: By the aid of a vernier and magnifying glass we divide these millimeters into tenths, making each 1/254th of an inch.

Cut No. 1 shows the camera in use in the Surveyor General's office. Immediately you will notice its mode of suspension and construction. This system lessens the amount of vibration always prevalent in large buildings, particularly along streets with heavy traffic. The cradle being hung from the ceiling by a number of stout springs, eliminates vibration through walking on the floor. The cradle is well braced on both sides, ends and cross supports. Iron rods are introduced with turnbuckles to prevent torsional vibrations. Along the lower part, both inside and outside, are V shaped steel rails upon which the lens carriage and plate carrier travel. This view was taken in 1912. Unfortunately, we are unable to photograph again from the same position owing to alterations having been made to our darkrooms.

This picture shows the camera extended to 6.5 times enlargement and the bellows drawn out 11 feet. Our latest bellows is made in three sections. The longest end of the conical shaped bellows is attached to a frame which fits automatically into either one of the other two bellows or directly onto the plate holder carriage.

Cut 2, shows the necessity of a shallow bellows on account of the closeness of the lens to the plate. The reduction now is 6.51, the plate carriage having remained stationary, the lens alone being altered. Attention is drawn to the board of wood construction that has since been replaced by one made entirely of aluminum. With these former boards, warping is almost impossible to avoid..



CUT NO. 2

Later an angle iron frame was made, the board being held to this in such a manner as to permit adjusting to take up warping from time to time.

The plans to be photographed are suspended on the board by pieces of adhesive tape and then a large plate glass in frame, running on steel tracks above is pressed against the copies keeping them flat and to a large extent eliminating creases and cockles.

Four lamps of about 5000 c.p. each hung on brackets are used, making sunlight unnecessary. Their positions are calculated so as to secure the most uniform illumination of the board.

Two apochromatic Tessar lenses are used in operating the camera, one an 18 in. focus and the other 33 in. focus. These lenses make it possible to reduce or enlarge at one operation 6·55 times.

A set of tables is provided for each lens to assist in fixing the position of the line and plate holder by means of the scale attached to the camera, and is more satisfactory than the old method of racking backwards and forwards with the additional aid of a yard stick.

Negatives up to 24 in. x 34 are made with the greatest accuracy. (To obtain these, diagrams were shown explaining the various methods adopted in keeping the plate holder and board parallel to each other.)

Before beginning the second part of the program I want to say a few words on behalf of the gentleman responsible for the construction of this camera.

It has been my pleasure to associate with him for the past fourteen years and during our daily intercourse, relative to work in connection with the camera, I have always found him a ready and sympathetic adviser. I appreciate very deeply the personal advantages I have gained through this association.

I have much pleasure in showing a slide of the Surveyor General.

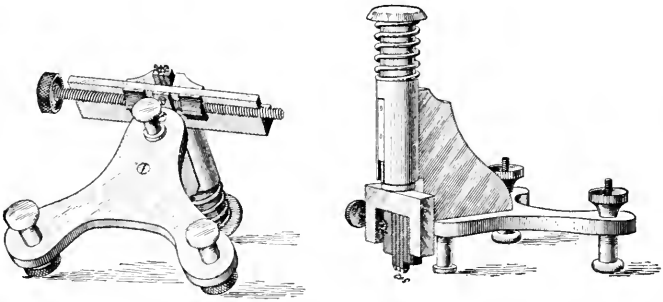
(Following this, slides were shown illustrating the many different styles of cameras used in commercial houses and the disadvantages encountered through the lack of means of adjusting the boards and plate holders.)

A camera manufactured by Penrose & Co., London, Eng., and supplied to the different colonial governments has a capacity for negative making up to 40″ x 30″ but unfortunately lacks the attachments for finer adjustments as provided in our own camera.

To proceed with the actual making of the maps let me enumerate a few of the chemicals used. First we have alcohol and ether, iodide of ammonia, iodide of Cadmium, Bromide of Cadmium, Chloride of Calcium, Soluble cotton, all of which go to make up the collodion or emulsion that forms the foundation for all our negatives, including developing, fixing, intensifying solutions; we use a total of something over 75 different chemicals.

The first step necessary in making a map is performed by a large number of the gentlemen present here to-night. To hear them talk of the hardships they encounter would make your blood curdle, but to see their bright and healthy faces on their return every fall proves there is nothing like getting close to nature: I speak of the surveyor.

In the draughting department are the real artists. These chaps are getting less and less to do since we went into the printing business.



This little brass tripod is a specially constructed type holder. It was introduced by the Surveyor General some ten years ago and has revolutionized the preparing of maps and plans. This little machine holds the type while a tiny ink roller is passed over its face. When laid on the plan in the proper position pressure is brought to bear on the handle and a clear sharp impression is the result. Uniformity is its keynote. One dozen stampers will turn out twelve different plans and all of a uniform appearance. Plans are stamped in about one-quarter the time usually required for drawing. Rivers, lakes, streams are the only details drawn by hand. Slide 47 shows the plan finished; at once you will notice its clean and uniform appearance. This style of plan is more easily read and is pleasing to the eye. The plan is now ready for its final reduction of 1.333, or 30 chains to 40 chains.

Having received the plan for reproduction the operator prepares his plate by flowing over with an even coating of collodion.

There is quite a knack in this, the operators becoming very expert, coating large plates, almost equal in uniformity to dry plates. The 24″ x 34″ plates are balanced on a padded pivot while the collodion is poured on by a second person. This plate is now placed in a silver bath to sensitize, the silver acting on the iodides and bromides of silver. This silver tray is the one used in our office. On account of the heavy weight of our large negatives ebonite baths are used in preference to glass ones. These trays are incased in an outer wooded one with a hinged top to keep out light and dust. When sensitizing the plate the tray lies flat and when not in use reclines at an angle.

About four minutes is required to sensitize the plate when it is removed to the dark slide or plate holder. This latter operation is performed in a yellow or ruby light. When handling large plates a special truck is used to convey the holder to the camera, where it has simply to be lifted a few inches to place in position.

The average exposure is forty-five seconds, wet plate negatives being less sensitive than dry plates.

The method of developing these plates is entirely different from that of dry plates. The negative is held in the left hand, while the developer, contained in a graduate, is swished across the plate retaining sufficient developer on the surface. The image appears in about five to eight seconds and is fully developed in about twenty seconds.

The developer is made up of sulphate of iron, acetic acid and water. After thoroughly rinsing under the tap, cyanide of potassium is flowed over for clearing. In the case of dry plates we use hypo for this purpose. The appearance of the negative is very much like that of an underexposed dry plate negative. After intensifying with copper and bromide of potassium, washing, then treating again with a 25 hydrometer test silver solution the negative will appear black.

All negatives require spotting and generally when they reach this stage someone in the compiling room discovers a W.P.M. has been stamped in where an I.P.M. should go We simply stop out the W. with a special retouching medium and engrave in the correction.

We are now going to print this negative on zinc. The large sheet of zinc is flowed over with a solution of powdered albumen, glue, water and ammonia and bichromate of ammonia as the sensitizing salt. The coated plate is laid on a large circular stand and clamped. By turning the handle, the whole top revolves throwing off the excess solution. Heat for drying is supplied from a gas jet. The negative having been placed in the printing frame with a mask all around, the lights are turned off and the zinc plate laid face down. Pressure is obtained from a vacuum pump. When the inside frame is placed over the rubber pad and the levers pressed down the tube is connected from the tank drawing out all the air remaining under the pad.

It is marvelous the contact obtained in this system. The glass in this frame is only ¼" thick, while in the old style frames one inch was the thickness used.

Four mercury vapour tubes each fifty-two inches long are used during exposure. After exposure about eight minutes the plate is painted over with liquid ink, rubbing off with cheese cloth. It is then placed under two faucets and the water turned on. Where the negative had been black or opaque preventing the light from acting on the bichromate, this ink will lift right off and by the assistance of a tuft of cotton every particle of ink between the fine lines will be cleaned away.

The photozincograph is dried by an electric fan and a thin solution of gum arabic flowed over to protect the surface before printing from corrosion or oxidization.

Our lithographic printing department on Queen Street is now called upon to assist us. The plate when passing through their hands receives several applications of mysterious dopes, all of which tend to strengthen the image to withstand the wear and tear while in the press.

Our latest achievement in photozincography was the publication of the map of part of Jasper Park in four colours.

This park was surveyed by Mr. M. P. Bridgland, D.L.S., and the results sent to head office drawn on tracing linen in black, brown, blue, red and green.

In reproducing a map of this kind a thin negative is made from the original tracing bringing out all colours. These negatives are then printed on zinc and from these impressions are pulled in pale blue ink on good quality drawing paper, which are then covered with shellac on the backs to assist in preventing shrinkage.

Drawings for the different colours are produced by simply inking in over the blue lines that which is needed. As I stated in my lecture a large percentage of the success of our photozincography was due to the draughtsmen employed in our draughting department.

This Jasper Park map was published in six sections and so accurately was each one copied, we were later able to join all sections and reproduce to half scale to an almost perfect register.

The Chairman.—There is now an opportunity to ask questions of Mr. Carruthers.

Mr. Seymour.—Mr. Carruthers mentioned the item of cost and one or two other reasons why photo-zincography is to be preferred to copper-plate engraving. Are there any other advantages that he has not named ?

Mr. Carruthers.—There is no fault to be found with the copper-plate so far as the engraving is concerned, but when it comes to the transfer to the stone or zinc plate, and this has to be run through a hand press under a pressure of six or seven hundred pounds, the fine lines are apt to be thickened and thus impaired. When our Jasper map was published it was shown to an expert copper-plate engraver in Toronto. When asked by what process it had been produced, he answered that it must have been done by copper-plate engraving. He remarked upon the fine lettering, particularly the black, and said that the engraving must have been done by an expert. He was surprised when told that the work had been done by photo-lithography.

Mr. Smith.—Do you find it necessary to check the adjustment of the lens board with the copy board and the plate, and if so how is it done ?

Mr. Carruthers.—In my little talk yesterday about the kodaks, I explained that, in so small a camera it did not matter so much about this adjustment, but in a camera the size of the one that we use, this may be a very serious obstacle. The procedure that we follow in order to get a proper adjustment would not be possible in a camera which had not a continuous millimetre rule to go by. If the lens board is not parallel with the plate holder, we place our magnifying glass on the right hand side of the plate and rack back and forward until we get the medium or mean definition. Then we take a reading on the scale and taking the other side, we rack back and forward in the same way. When we have reached the medium or mean definition there we note the reading on the scale. Subtracting one reading from the other we have a factor by which we can calculate the extent by which the lens board must be altered. If the alteration is small we can alter the flange, and if it is too large, strips must be added at front and back to bring it parallel. We did that with our camera eight years ago and we are arranging to do it again next month.

Mr. Rannie.—The paper of Mr. Carruthers is quite up to the standard of this and former meetings of the Association. Few of us who go into the field understand the work of map production which has been so clearly explained to us to-night. Our knowledge is pretty well confined to the production of field data. Three or four years ago the International Joint Commission desired topographical maps of the Lake of the Woods District. About forty maps were required. They were wanted in a hurry. It was also required that the best of work should be done at all stages. By the great courtesy of the Surveyor General, Mr. Carruthers, and his staff undertook the photographic part of the production of these maps. If you were to ask some of the departments to tell you how long a time elapses from the completion of the field work to the printing of copper engraved maps, I think they will tell you from two to three years. The fact that the International Joint Commission maps were ready for distribution in about ten months and that they were highly satisfactory is attributable partly to the success of Mr. Carruthers' photographic methods and his skill in his work. The International Boundary maps of Southeastern Alaska are also the work of Mr. Carruthers so far as the photography is concerned. This also is a great tribute to Mr. Carruthers and his staff, as well as an indication of the excellence of the machinery provided for him. Those of us who have not hitherto realized the full significance of this work have been greatly benefited by to-night's explanation, and I think that the members of the Association and our visitors of this evening are greatly indebted to Mr. Carruthers for his address.

Dr. Deville.—Mr. Carruthers has enabled you to understand what a complicated thing this map making is. It requires an expert such as you seldom find; not many are able to do this work as it is done by him. A point about this camera requires explanation: why we use the millimetre. The question is asked, why not use an ordinary inch scale decimally divided. But if you divide an inch into tenths, the divisions are too coarse, and if you attempt to divide the tenths into hundredths, you have divisions too fine to be followed accurately by the eye. The millimetre is just the right size. You have been shown by Mr. Carruthers representations of very large cameras; our is only 24 x 34 inches. In the great survey establishments they have very large cameras requiring the use of enormous plates that take several men to carry. To coat these plates is a very difficult operation. Those who have tried to handle plates of the size of ours find it quite an effort. The reason why very large cameras are used is the difficulty to photograph a map in two pieces and make these two pieces join. But that is no trouble for us; we can make a map in as many pieces as we wish and be sure that they will join. We have reached such a point of perfection that it is almost impossible to distinguish between our photo-zincographed maps and maps engraved on copper; not many, even experts, can tell the difference. The credit for that is to be divided among Mr. Carruthers, the draughtsmen who produce the maps, and the printers. If Mr. Carruthers had not such perfect originals to work from, he could not succeed, and on the other hand, if the men who draw the maps had not a man of such skill as Mr. Carruthers to prepare what they draw, their work would be in part lost. Poor printing would spoil the work of both.

A question has been asked as to the adjustments of the camera. It is not exactly as it ought to be: it ought to be made entirely of metal, while it is built of wood to a large extent and is subject to the variations of that material. But the adjustments are easily made. When the slightest distortion is noticed, it is measured and the correction applied, as Mr. Carruthers has explained.

Our mode of working in producing maps in colours is to make a separate original for each colour, and then photograph each of these originals to the same size. It is necessary to have accuracy in this process in order that the colours may "register." Sometimes there may be a contraction in one or more of these originals. But that makes no difference to Mr. Carruthers. He photographs them all to the same size exactly. If there are other places where this is done in the production of maps, I have not heard of them. One slide thrown on the screen to-night was a map of Jasper in colours, and Mr. Carruthers explained how that slide was made. The process is new to me and it is a very bright idea. The work of Mr. Carruthers is well known to lithographic firms throughout the country and appreciated by them.

While we are speaking of maps I would like to show you another kind of map, one that is supplied to officers at the front for their use.

Dr. Deville then produced a map of Vimy, showing the relation of the Canadian and German lines. He explained that the data for it were obtained from photographs made from aeroplanes. His explanations were followed with keen interest by the audience.

The Chairman.—On behalf of the Association I extend to Mr. Carruthers our very hearty thanks for his interesting lecture and to Dr. Deville for his remarks.

The meeting adjourned until 10 o'clock the following morning.

THIRD DAY—MORNING SESSION.

Mr. Dodge, for the Nominating Committee, submitted names of members recommended for the several offices and also names of members chosen for committees.

He spoke as follows : The Executive asked us to select special committees on the following: Publication and Publicity; Geodetic Survey; Topographical Surveys; Dominion Lands Surveys and Advisory. I may say that the Nominating Committee intended to suggest the name of Mr. Shanks for President, but Mr. Shanks when approached on the subject declined for reasons which he no doubt will explain. I move the adoption of this Report.

Mr. Fawcett seconded the Resolution.

Mr. Barber.—I notice that the Executive Committee as composed is made up entirely of field men. This may be disadvantageous to the Association. Possibly Mr. Shanks, if he does not wish to be President might consent to act as Vice-President.

Mr. Shanks.—I asked the Committee as a personal favour not to place me on the card as President. I think the Association has been drifting consciously or unconsciously, too much into the hands of the inside men. My views on this point were strongly supported by the Surveyor General. In fact he raised the point independently of our discussion and not being aware of it. Of course, I could not be insensible to the honour that would be conferred upon me by appointing me President, but I am willing to forego that honour for the sake of the Association, and I am perfectly sincere in saying that the field men should take an active part in the Association and that the inside men should, as far as possible, try to place control in the hands of the field men. The Association will never have the influence it ought to have unless it is an Association of field men primarily.

The resolution to adopt the Report of the Nominating Committee was carried.

The President then called for the report of the Special Committee on Finance.

Mr. Pierce submitted the Report of the Special Committee on Finances as follows:

REPORT OF SPECIAL COMMITTEE ON FINANCES.

The committee has considered the question of reduction of our current expenses and increase of revenue, with a view towards making them more equal and has the following recommendations to submit:

That the publication of the Annual Report is vital to the interests of our Association and should not be discontinued under any consideration.

That the size of the Report could be reduced advantageously by condensing the discussion into a prècis, or by eliminating some of it.

That the question of publishing extracts of some papers, particularly those which overlap, might be considered by the publication committee.

That the Secretary look very closely into the number of Reports needed with the view of reducing the number to be printed.

That the reporting of our proceedings be done by one of the staff of the Department of the Interior, as we have been told on good authority that there will be no trouble in securing such a stenographer. A large fee will thereby be saved.

That articled pupils be admitted to membership at reduced rates.

That Messrs. Narraway and Lonergan be authorized to accept fees on behalf of the Treasurer, and issue receipts for dues, arrears or new fees.

That the Executive use their utmost endeavour to reduce the deficit which annually accompanies our dinner.

That those members more than three years in arrears be dropped from our membership, as they are a drag upon our resources, and that no member in arrears be elected to office in this Association

That an increased grant of at least $125 be asked for from the Government.

We suggest that it be recommended to the Surveyor General that in the future no one be employed on Dominion land survey work, who is not a member in good standing in the Association.

Attention is called to the fact that fifty active members are in arrears to the extent of about $338.00 and fourteen members at present employed by the Department, inside and out, are about $70.00 in arrears.

Mr. Seymour moved that the report be referred to the incoming Executive.

Mr. Rannie seconded the motion. He said: There are one or two other points on which I wish to say a word. Our dinner this year I think we all agree, was very successful. We had eighty members present as against thirty or forty at last year's function. But it is a curious thing that the more successful our dinner the more we have gone into the hole about it. This year the dinner cost $1 a plate while each purchaser of a ticket paid 75 cents. Then we spent $12.50 in cigars, and we had a dozen guests. It seems to me that the incoming Executive should see that the dinner should pay for itself. Then I have a suggestion for the Publication Committee. I think that more might be done to make our Report self supporting by means of advertisements. Last year, I understand, through some misunderstanding or difficulty, one or two ten dollar advertisements failed to get into the Report. I should think that from this source our financial position in this publication could be improved by at least $50. One other item I approach with great diffidence. The publication of the Report has entailed upon the Secretary-Treasurer a large amount of work. Knowing that he is put to more work than the other members of the Executive, the Association has given a small present each year to mark its appreciation. It occurred to me that it might be possible, now that we have a Committee on Publications, to take quite a lot of the work from the shoulders of the Secretary-Treasurer, to be borne, as it ought to be, by the members of the Association. The inference is, perhaps, that we could do something in that regard; how much, I am not prepared to say.

The Resolution was adopted.

The President.—Mr. Cauchon has been kind enough to accept our invitation to address the meeting on the subject of Town Planning. I am sure we shall be pleased to hear him.

Mr. Noulan Cauchon. I am not going to attempt a lecture on Town Planning. The subject is one in which I have been interested for many years. The Commission of Conservation took it up three years ago and obtained the services of Mr. Adams who, since that time, has been making representations to different groups and organizations endeavouring to interest them in the question. Let me say at once that this is not a matter of gardening or landscape work. It is a proposition for the proper control, development and use of the land in order to prevent crowding in the cities and isolation in the country. For we have slums in the country as well as in the city though from an entirely different cause. One is due to isolation, one to congestion. The reason I appreciate the privilege of addressing the Association of Dominion Land Surveyors on this subject is that they are the people most needed to take up the work. The Northwest has been surveyed far beyond the requirements of the people who are going into that country at this time. It is questionable whether there will be any great immigration after the war; for my part I do not expect it. Our population since 1912 has been diminishing rather than increasing and now numbers probably about 7,000,000. The problem before us is how to dispose of our natural resources in the most efficient manner possible. One of the most efficient things that we can do is to conserve the life that exists here. When I tell people at pubic meetings, as I often do, that the width of streets and the proportion to that width of the height and area of buildings has a great effect on the birth rate and the death rate they begin to look at me as though they thought my mind was wandering. But, as a matter of fact these things have a very vital relation. We are not dealing now with any former system of town planning or any system carried on under old conditions. We are dealing with huge populations with vast transportation systems and a manufacturing industry accelerated by a thousand mechanical inventions. Therefore we have a totally different economic organization, a totally different social condition to deal with from that which formerly existed. Take this as an illustration on this subject of the width of streets. If the streets in the working-class quarters of a large city are laid out too wide, with boulevards and all the rest of the embellishments of civilized existence, the taxes to pay for all this levied on the adjoining property, must be relatively high. It is easy to see that the cottage of the working man will not pay a revenue to support all this and yield a return to the landlord. The result is you must have two, three, a dozen, fifteen or twenty houses on the space that the workingman's cottage would occupy. That is to say, you must have tenements. You can see that in this way the width of streets has a direct effect upon social conditions. In Germany—to cite a very bad example and a very glaring one—they attempted the work of town planning on a magnificent scale, covering the working class quarter as well as the rest. The result is you go through magnificent streets, each with its three boulevards, and with tenements on either side of the streets. The workmen live in houses six stories high. Over a million people live in tenements of two rooms to a family. Take the case of a working man and his wife with two or three small children living on the fourth floor of one of these tenements. Of course, the children could go down and play on the boulevard, if there was anybody to care for them. But the mother is too busy to go with them, and the father does not get home until night after the children are in bed. So these children grow up in these one or two rooms in which the family live, sleep, cook, eat, and do their washing. You can understand the effect on the lungs of the rising generation. In spite of the magnificence of the external of these tenements, the death rate among children from tuberculosis is two and a half times as great as that among children brought up in the slums of Great Britain, who roll in the gutter. I simply cite this as a proof that the width of streets has a direct bearing upon the condition of the population.

The Northwest is now offering less opportunity for Dominion Land Surveyors than it used to offer and they should look for something else. Economic town planning affords that opportunity. Mr. Adams has been going to the different provincial governments, and the provinces have been passing town planning laws. Thus it will become a provincial matter everywhere, and the town planning laws that have been passed mean that cities, towns and villages will take up seriously the question of town planning, the laying out for the future and correcting what has been done wrong in the past. That calls for men in charge of the work who are qualified town planners. Now, we have in Canada very few men who are so qualified. The land surveyor has the ground work, he is, so to say, the most fertile soil in which to sow the seed of the knowledge of town planning. He is familiar with the country and the laying out of land. Hitherto he has laid out land in the old conventional way, but he is familiar with the technical methods of laying out land. Then he has a scientific training and a receptive mind. I do not know anybody outside the ranks of the engineering profession who would have a better start in this work—and believe me, the work is coming. The engineers are not in as good a position as the land surveyors to take up this work. Town planning offers an opportunity for a man to make his home in one locality. But, with the engineer, every piece of work means a move, until he gets old, and then he is set aside for somebody younger. In other professions like that of the lawyer or of the doctor, the difficulties are at the beginning, but these are overcome by time and the results of effort are cumulative. But with us engineers it is different. We make a great effort on a certain work to-day and tomorrow when that work is finished we must go elsewhere. Let the engineer settle in one place and soon there is no work for him to do. But town planning offers this element of permanency to those who take it up. The town planner becomes a permanent official of the city or town. I simply offer this as something for you to think about. The need for qualified men is coming and it will come after the war. When the war is over we shall have an enormous debt, and practically everything must be done to retrieve the situation in the most efficient manner. When the call comes for town planners if nobody in Canada is prepared to answer, this country will have to call upon the United States and must bring in a great number of men from that country. But the main drift of town planning in the United States has been toward the architectural and landscape side, not the economic side—the economic side has been more developed in England and on the continent of Europe. An influx into this country of men trained in the landscape side of this subject would affect the trend of the whole movement here. That is not what we want. What we want is to improve the conditions under which our people live and to avoid an increase of that economic inequality which is so injurious to individuals and so dangerous to society—commercial cannabalism it has been called, that is, using up the lives of others for our own benefit, which is precisely what happens when people are called upon to work under conditions that shorten their lives, that, in fact, kill them. The primary object in building a house is not to provide something that is architecturally beautiful; the primary object is to provide a place in which people may live. Men of scientific training can clear the field of errors in these things in a shorter time than can those who are not trained. You have the Conservation Commission as a help, but its function is purely advisory. You must also have the executive department. In other words the executive branch of each provincial government will have to take up this matter. For a long time I have been advocating that there should be a national school of town planning here in Ottawa to train Canadians in this service, so that when the towns and cities of this country need their services the men may be ready. And I do not know any organization which offers the same ground work of scientific training, experience and ability as the Association of Dominion Land Surveyors. Not only are the men of this service men of ability, but they are backed by the high qualifications of Dr. Deville, who has shown as great an interest in town planning as anyone I know. My suggestion to the government would be that the Surveyor General's Branch should be made the town planning department of the Dominion and that a school of town planning should be carried on under their auspices. Their work in that school should be supplemented by that of men trained in sociology and housing. This work offers a very great future. I do not know that the rewards from a monetary point of view will be very great, but, the services will be very great, and I have no doubt that it will be compensated in proportion to its efficiency. I would like to see the Minister of the Interior approve of a school of town planning and set in motion the means for bringing it into workable and useful existence. If we do not take some such step as that all the time given to the work of town planning, the propagating these ideas and enlightening the public will be wasted. It is a most interesting work and has inexhaustible ramifications. The more you work at it the more interested you become and the more efficient.

If any of the gentlemen present would like to ask questions I would be glad to answer them if I can.

The President.—On behalf of the Association I extend our cordial thanks to Mr. Cauchon for his address. The subject is open for discussion.

Mr. Seymour.—I think it will be a fitting opening of the discussion if I read part of a letter which I have received from Mr. Adams:

The time has come, however, when surveyors can gladly assist in the proper development of the country by applying initiative and using their knowledge to secure the development of land on principles which will stimulate production. It is in the direct interest of surveyors themselves that they should widen the scope of their profession and encourage the greater use of their services in connection with land development. I think the matter is one which should not only be discussed in connection with the actual work of qualified surveyors but also in connection with the training of students and the widening of the qualifications of probationary members. I would suggest, for instance, that you should have a special diploma to be granted to those who qualify themselves in town planning. It should be optional for members to be examined for the special diploma and all land surveyors should be encouraged to acquire the knowledge necessary to take it.

I should be glad to discuss the matter with any committee and to make suggestions as to the practical course which should be followed.

Dr. Deville.—Mr. President, I wish to endorse very heartily the views expressed by Mr. Cauchon. We cannot be sure of what the conditions will be after the war, but one thing is certain, we cannot expect to follow after the war our easy ways of before the war. We will have to organize work in a more efficient manner than formerly. Our principle hitherto has been that of perfect freedom for everyone to do as he pleases. It is a good principle, but not the best for efficiency. Something of the nature of what Mr. Cauchon has indicated will have to be done; there must be greater efficiency and greater co-operation. Town planning, community planning, or whatever you call it means better organization generally. It is something new here though it is not new in the older countries, such as England and Germany. Something is required in that line, and the Dominion Land Surveyors are the men best qualified to take it up. In the old countries it has been taken up largely by architects, because the profession of land surveying in the sense that we understand here does not exist. They have no body of university graduates qualified as land surveyors ready to take up this work. Everything that the Dominion Land Surveyors can do to encourage the movement should be done. Just what is the best way to do it I am not prepared to say at present. It may be that a start could be made by some voluntary association. I have always taken a great interest in town planning mainly on the landscape side, as that is what appealed to me rather than the economic side, but I do not see any reason why both these should not be in line with the regular work of the land surveyor. I have spoken of possible action by some voluntary association. Some time ago, I was in communication with a civic association in Chicago, who advertised a competition in town planning. Chicago, as you know, is in a perfectly flat plain, and such a site offers the minimum of opportunities from an artistic point of view. The results were very interesting. Sixteen or eighteen plans were submitted, some of them of very great merit. Perhaps, some similar association might take up this work, or it might be left in Government hands as Mr. Cauchon has suggested.

Mr. Barber.—One of the sub-committees we have appointed is that on Topographical surveys. I would move that this matter of town planning be referred to them with the request that they inquire into it and recommend some means of carrying out the suggestions made by Mr. Cauchon, Mr. Adams and Dr. Deville.

The motion was seconded by Mr. Rannie.

Mr. Cauchon.—My reason for suggesting that this matter should be taken up by the Dominion Government is that every civilized country in the world except Canada gives encouragement to art. For instance, nearly all countries have municipal and national theatres or both. They recognize the theatre as a means of education. We stick to the belief that all the nation should do for its people in the way of education is to teach them the three R's and help them in some training that will enable them to earn their bread and butter. These other nations know that you must develope the soul and mind of the people as well as teach them to barely earn a living. France has its Ecole des Beaux Arts. Every pupil passing a good examination in the minor school passes into this college where he receives the best instruction. They have other schools maintained for the developing and teaching of the various branches of science. I speak freely on this subject. I am not a civil servant and do not care who may be hurt by what I say. I think our Government here should step forward and establish such a school as I have spoken of on the ground that art is to be recognized as a necessary part of education. Not only town planning could be taught but a variety of subjects might be included in its courses of lectures. A voluntary association, as suggested by Dr. Deville, would be a beginning. But the work must be backed up with a substantial fund, and nobody can give this but the Government, and it is the duty of the Government to give it. It is only recently that manual training was introduced in the schools. Still later came the Montessori system, which was first developed as an aid for children who are mentally deficient. It was found that when those who were mentally deficient had been trained in this system and joined the other children in their classes, they made more rapid progress than the others. The intense industrialism of the eighteenth and nineteenth centuries has given a peculiar twist of mind to civilized man. The subdivision of labour has become so great that the average man has lost touch with the elemental in life. The early man did not develop by reading the Shakespeare of his time but by making stone hammers and chisels. He was developed by his efforts to produce the tools necessary to make his living. But the second stage came when he tried to beautify the implements that he used. Some of the ancient tool handles in ivory or bone have as fine ornamentation as anything we can show to-day. These are the two factors of training and development—industrial necessity and artistic instinct. And we must come back to these facts. We do not teach art as an essential thing but as an "extra", like piano playing in a ladies' school. Every child should be taught not only manual training but art. I do not say that every child should be made a painter or sculptor, but I do say that person should be able to express his ideas on paper with a pencil in a true manner. That is a fundamental of education, and it is the basis of my arguments that it is the duty of the nation to have a great school to promote the idea of training men who will be able to carry that gospel into effect in the dwelling places of the people. Town planning is simply one feature of it, simply the economic side of life. That is why I say it is the duty of the Minister of the Interior to take this up and to establish the school I speak of as a recognized activity of government.

Mr. Barber's motion to refer the subject of town planning to the Topographical Surveys Committee was carried.

Mr. Cauchon.—If the Association is to take up further the subject of town planning I shall be glad to render any help I can.

The President.—It was expected that at this sitting we should discuss the papers of Messrs. Norrish, Cowper and Pierce, which were read on Wednesday.

Mr. Shaver.—There is great difficulty in criticizing these papers when we have heard so much since they were read. I think it would be better to criticize one paper before another is brought forward. As to this matter of town planning, one scheme proposed is that of having the farmers live in a central village and go to their work in motor trucks. The farmers themselves should criticize such a proposition. I do not know who is responsible for proposing it nor do I care; it is an utterly impracticable idea. The farmer has to live close to his stock—the idea of a man going three or four miles in a motor truck to feed his horses. But perhaps it is intended that the tractor shall take the place of horses altogether. But the idea, I think, is simply ridiculous. There should be a practical as well as a theoretical side to this idea of town planning. I was raised on a farm, and I never heard of such a ridiculous proposition before.

Mr. Shanks—I would like a further discussion of our financial situation. Are we going to get into debt, or are we going to pay our way? If we have debt ahead of us, I think it would be better for us to get out of business as an Association. And I do not see any other result if we continue on the old line. I do not think we can hope for a large increase in fees, nor am I confident of an increased grant from the Government. Are we to leave everything in the hands of the Secretary-Treasurer as will be the case if it is left to the Executive, as its members are not in town? If so, what does he propose to do? I do not think he wants it left to him, and I thing we should face the question now.

Mr. Blanchet.—I should think we ought to get enough advertisements in the Report to pay the expense of publication.

The Secretary.—Circulars, the form of which was approved by the Executive were sent out but they did not bring the results we hoped for and even some of the firms whose advertisements we had carried in former Reports turned us down. Mr. Rannie offered to help in getting advertisements, and if others would help in the same way our revenues could be considerably increased. This ought to be taken up by the Executive as well as by members of the other committees and gone into thoroughly.

The President—I was surprised to learn that the Association had gone in the hole over its luncheon to the amount of over \$40. It has been said that the members would not pay \$1 for a luncheon and so the price was fixed at 75 cents. That is not a proper spirit for an Association of this kind. The man who would hesitate at an expense of 25 cents once a year to pay his share of a function that brings us in contact with those who can do something for us, exhibits a spirit which will destroy the Association.

Mr. Barber.—I think the situation brings out clearly the disadvantages of having the Executive composed almost entirely of men who are in the field. I would suggest a small committee to look into this whole question of finance, to consider means of financing, the collection of fees and the securing of advertisements. That committee could collaborate in this work with the Secretary-Treasurer.

Mr. Rannie.—A good deal of our expense will come between now and next May, that is, before the surveyors go out. The Executive could do a great part of the work before that time and thus not leave it to the Secretary-Treasurer, though he has borne it heretofore. It is only by the members taking their own part that the Association can be made to succeed. I would suggest that this matter be left in the hands of the Publication Committee. They are level headed men, and eminently able to deal with this question. I put that as a motion.

Mr. Shanks.—I think that is a practical way of dealing with the difficulty and I have pleasure in seconding the motion.

Mr. Akins.—There is a considerable amount due the Association in back fees, is there not ?

Mr. King.—There are fifty active members not now in the employ of the Government who are in arrears $338. There are fourteen men in the civil service and employment outside who are $70 in arrears.

Mr. Norrish.—Would it be within the power of the Executive to increase the fees ?

The Secretary.—No.

Mr. Akins.—I think that a good part of the back fees could be collected. I believe that a majority of those in arrears are not so by intention, but simply by putting off the matter. I suppose the majority of these members live in Ottawa or in Edmonton. If a man were appointed in each place to make a personal request for the payment of fees I think most of the money would come in.

Mr. Rannie.—Last year I had as much hope as you had. But a year's experience has made me hopeless.

The Secretary.—This matter has been discussed several times as I explained before, but the arrears stated still remain.

Mr. Rannie's resolution to refer the question of finances, etc., to the Publication Committee was carried.

The Secretary.—I have received two papers prepared to be read at this meeting of the Association but they have come to hand too late.

Mr. Dodge moved that the papers referred to be handed to the Publication Committee to be dealt with.

The motion was seconded and carried.

The Secretary.—I think our thanks should be expressed by letter to Mr. Sykes, Public Librarian, for the use of this hall. He has been very kind and generous to us. Mr. Shanks yesterday suggested the sending of some similar letters and I think he will agree this one should be sent. I think we are very fortunate in having Mr. Sykes to deal with and I move that a letter expressing our thanks be sent to him.

The motion was seconded and agreed to.

The meeting adjourned sine die.

LIST OF MEMBERS

PATRON :

E. DEVILLE, LL.D., I.S.O., D.T.S., Surveyor General, Ottawa.

HONORARY PRESIDENT :

OTTO KLOTZ, D.Sc., D.T.S., Chief Astronomer, Ottawa.

HONORARY MEMBERS :

R. H. CAMPBELL, Director of Forestry, Interior Dept., Ottawa.
HON. J. P. B. CASGRAIN, D.L.S., Senator, Ottawa.
J. S. DENNIS, D.T.S., Assistant to the President of C.P.R., Montreal.
C. A. MAGRATH, D.T.S., Fuel Controller, Ottawa.
M. McFADDEN, D.L.S., Brandon, Man.
W. J. STEWART, Chief Hydrographer, Naval Service Dept., Ottawa.
P. B. SYMES, Ottawa.

PAST PRESIDENTS :

E. W. HUBBELL, 1907—8
R. E. YOUNG, 1909—10
T. FAWCETT, 1911
P. R. A. BELANGER, 1912.
C. F. MILES, 1913
C. F. AYLSWORTH, 1914.
A. H. HAWKINS, 1915—1916
J. J. McARTHUR, 1917.

ACTIVE MEMBERS.

Note: Members whose names are marked thus * have enlisted for Overseas Service

Date of Admission.	Name.	Address.
1912—	Akins, J. R.,	R.R. 4 Queenston Street., St. Catharines, Ont.
1907—	Aylsworth, C. F.,	Madoc, Ont.
1913—	*Baird, W. J.,	Scarboro, Ont.
1914—	Baker, M. H.,	St. Thomas, Ont.
1910—	Barber, H. G.,	Topographical Surveys, Ottawa.
1916—	Bartley, T. H.,	11 Melbourne Ave., Toronto.
1907—	Bayne, G. A.,	c/o H. B. Co., Winnipeg.
1917—	Beatty, D.,	Parry Sound, Ont.
1915—	*Beatty, F. W.,	Pembroke, Ont.
1918—	Benner, J. K.,	Port Arthur, Ont.
1912—	Bennett, G. A.,	Tillsonburg, Ont.
1914—	*Beresford, H. E.,	Portage la Prairie, Man.
1915—	Beresford, H. G.,	859 Ingersoll St., Winnipeg.
1913—	*Berry, E. W.,	Thomas Blk., Calgary.
1910—	Bigger, C. A.,	Geodetic Survey, Ottawa.
1909—	Bingham, E. R.,	418 Victoria Ave., Port Arthur, Ont.
1911—	Blanchet, G. H.,	110 Frank St., Ottawa.

Date of Admission.	Name.	Address.
1913—	Boulton, W. J.,	Topographical Surveys, Ottawa.
1912—*	Bowman, E. P.,	West Montrose, Ont.
1907—	Brabazon, A. J.,	Geodetic Survey, Ottawa.
1910—	Bray, S.,	Chief Surveyor, Indian Dept., Ottawa.
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1912—	Dennis, W. M.,	Geodetic Surveys, Ottawa.
1917—	Dennis, T. C.,	Boundary Surveys. Ottawa.
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1909—	Dodge, G. B.,	Topographical Surveys, Ottawa.
1913—*	Donnelly, C. B.,	Winnipeg.

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1915— Doze, J. W., Fort Saskatchewan, Alta.
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1914— Ewing, E. O., Toronto.

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1907— Fawcett, A., Gravenhurst, Ont.
1907— Fawcett, T., D.T.S., Boundary Surveys, Ottawa.
1914— Fawcett, S. D., Topographical Surveys, Ottawa.
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1915—*Fletcher, W. A., Thornton, Ont.
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1907— Galletly, J.S., Oshawa, Ont.
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1913— Hamilton, C. T., 73 Exchange Bldg., Vancouver.
1911—*Haggen, R. W., Revelstoke., B.C.
1914—*Hardouin, J.,
1913— Harris, J. W., Assessment Commis. and City Surveyor, Winnipeg.
1910—*Harvey, C., Kelowna, B.C.
1907— Hawkins, A. H., Topographical Surveys, Ottawa.
1907—*Heathcott, R. V., Edmonton.
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1907— Hopkins, M. W., Edmonton.
1907— Hubbell, E. W., Chief Inspector of Surveys, Int. Dept., Ottawa.

1911—*Inkster, O,. Edmonton.

1917— Jackson, J. E., 164 Cumberland Ave., Hamilton, Ont.

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1909— Jephson, R. J., Box 986, Brandon, Man.
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1917— Knight, R. H., Edmonton.

1917— Lambart, H. F. J., Geodetic Survey, Ottawa.
1912— Latimer, F. H., Penticton, B.C.
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1917—*Murdie, W. C., Geodetic Survey, Ottawa.

1911— Narraway, A. M., Controller of Surveys, Topographical Surveys, Ottawa.
1912—*Neelands, R., Hamiota, Man.
1909—*Nelles, D. H., Boundary Surveys, Ottawa.

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1912— Neville, E. A., 936 Granville St., Vancouver.
1915— Norrish, W. H., Topographical Surveys, Ottawa.

1910— Ogilvie, N. J., Superintendent of Geodetic Survey, Ottawa.

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1912—*Palmer, P. E., Topographical Surveys, Ottawa.
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1910— Pearce, Wm., Calgary.
1913—*Pearson, H. E., Edmonton.
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1907— Phillips, E. H., Regina, Sask.
1918— Phillips, E. P. A., Port Arthur, Ont.
1911— Pierce, J. W., Pembroke, Ont.
1914—*Pinder, G. Z., Credit Foncier Bldg., Edmonton.
1911— Plunkett, T. H., Meaford, Ont.
1912— Powell, W. H., City Engineer's Office, Vancouver
1911— Purser, R. C., Ottawa.

1911— Rainboth, G. L., Boundary Surveys, Ottawa.
1916— Rannie, J. L., D.T.S., Geodetic Survey, Ottawa.
1913— Reid, John, 161 Lenore St., Winnipeg.
1907— Reilly, W. R., Regina, Sask.
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1918— Rice, F. W., Topographical Surveys, Ottawa.
1915— Roberts, O. B.
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1910— Ross, J. E., Kamloops, B.C.
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1907— Saint-Cyr, J. B., 65 Laval Ave., Montreal.
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1912—*Seibert, F. V., Edmonton.
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1909— Steele, I. J., Ottawa.
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1912— Stewart, N. C., 2168 York St., Vancouver.
1911— Stewart, W. M., Saskatoon, Sask.
1917— Stewart, A. D., Natural Resources Intelligence, Br., Int. Dept., Ottawa.
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1911— Stuart, A. G., Winnipeg.
1911— Street, P. B., 17 Spadina Road, Toronto.

1917— Tassie, C., 1120 W. Pender St., Vancouver.
1914—*Taylor, W. E., 323 Glen Road, Toronto.
1911— Taggart, C. H., Kamloops, B.C.
1908— Teasdale, C. M., Concord, Ont.
1913— Tipper, G. A., 196 Marlborough Ave., Brantford, Ont.
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1912—*Tremblay, A. J., Edmonton.
1907— Tyrrell, J. W., 7 Hughson St., Hamilton, Ont.

1911— Underwood, J. E., Saskatoon, Sask.

1913— Van Skiver, L. A., Demorestville, Ont.
1913— Von Edeskuty, J., Vancouver.

1913—*Waddell, W. H., Edmonton.
1911— Walker, C. M., Topographical Surveys, Ottawa.
1911— Wallace, J. N., President D.L.S., Association, Calgary.
1914— Warrington, G. A., Public Works, Winnipeg.
1913—*Waugh, B. W., Topographical Surveys, Ottawa.
1907— Watt, G. H., Topographical Surveys, Ottawa.
1907— Weekes, A. S., 540 Sutherland St., Edmonton.
1912— Whitcher, A. H., Ottawa.
1912— White, W. R.., Indian Affairs Dept., Ottawa.
1912—*Whyte, H. E., 926 N. Park St., Victoria, B.C.
1917— Wight, E. J., Topographical Surveys, Ottawa.
1912— Wright, A. E., ''Rusholme'', Dundas St., Toronto.
1918— Wright, J. G., Box 546, Valleyfield, P.Q.

DECEASED MEMBERS

Joined the Association	NAME.	DATE OF DEATH
1907	Reid, J. L.	June 18th, 1911.
1907	Selby, H. W.	August 23rd, 1910. (Drowned).
1907	Stacey, A. G.	June 4th, 1908.
1907	Young, R. E.	October 24th, 1911.
1907	King, Dr. W. F., C.M.G.	April 23rd, 1916.
1907	Holcroft, H. S.	Died on Active Service, 1916.
1908	Green, W. T.	November 1st, 1909.
1908	Ratz, W. F.	February 6th, 1909.
1909	McLean, J. K.	May 25th, 1913.
1909	Rainboth, G. C.	November 2nd, 1910.
1909	Brady, James	
1910	Gordon, M. L.	1917. (Killed in Action).
1910	Lemoine, C. E.	1917.
1910	Mackie, F. H.	December 23rd, 1912.
1910	Robinson, E. W.	August 14th, 1916. (Drowned).
1911	Earle, W. S.	April 2nd, 1916. (Killed in Action.)
1912	Ogilvie, Wm.	November 13th, 1912.
1912	Hunter, A. E.	July 14th, 1914. (Drowned).
1912	Ponton, A. W.	January 21st, 1915.
1913	Johnson, C. E.	December 311st, 1913.
1913	Carthew, W. M.	June, 1916. (Killed in Action).
1914	Gass, L. H.	April 8th, 1917. (Killed in Action)
1915	Bolton, L. E. S.	June 13, 1916. (Killed in Action).

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ANNUAL REPORT

OF THE

Association of Dominion Land Surveyors

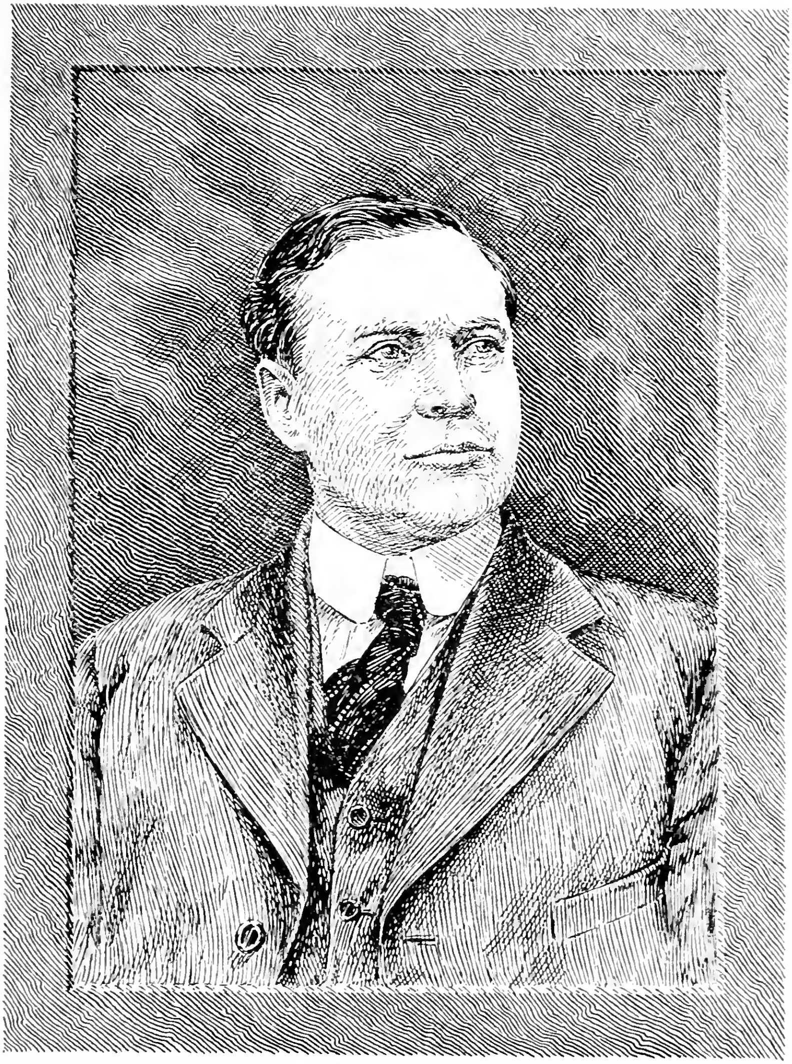
Twelfth Annual Meeting

HELD AT

OTTAWA

ON THE 29th, 30th and 31st JANUARY, 1919.

OTTAWA:
The Dadson-Merrill Press Limited
1919



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TWELFTH ANNUAL MEETING

The Twelfth Annual Meeting of the Association of Dominion Land Surveyors was held at the Public Library Building, Ottawa, on January 29th, 30th and 31st, 1919.

WEDNESDAY, JANUARY 29—MORNING SESSION.

The Meeting was called to order at 10 o'clock by Mr. J. N. Wallace, D.L.S., President. The following is a list of those who were present either at the opening session or at some time during the continuance of the meetings:

Dr. Deville, Dr. Klotz, Thos. Adams, J. R. Akins, W. B. Armstrong, C. H. Attwood, H. G. Barber, T. H. Bartley, G. A. Bennett, C. Bigger, G. H. Blanchet, W. J. Boulton, L. Brenot, F. E. Buck, J. H. Byrne, C. S. Cameron, D. H. Campbell, M. J. Carroll, H. K. Carruthers, W. Christie, R. F. Clarke, M.C.; T. H. G. Clunn, M. F. Cochrane, J. M. Coté, R. A. Courtnage, G. C. Cowper, J. D. Craig, R. M. Cram, A. S. Cram, W. D. Cromarty, A. L. Cumming, P. W. Currie, W. P. Daly, E. M. Dennis, W. M. Dennis, G. B. Dodge, R. Douglas, A. J. Elder, C. Engler, S. D. Fawcett, T. Fawcett, G. H. Ferguson, M.C., O. S. Finnie, Mr. Forward, L. Goodday, E. F. Gorman, K. D. Harris, A. H. Hawkins, F. D. Henderson, H. E. Hayward, Geo. Hogarth, W. A. Johnston, G. S. Jones, J. A. S. King, F. H. Kitto, H. F. Lambart, P. M. LeBlanc, M. Lindsay, G. J. Lonergan, W. E. Lumb, W. J. Lytle, J. B. Milliken, T. S. Mills, R. H. Millson, J. J. McArthur, A. F. McCallum, W. D. McClennan, K. F. McCusker, T. A. McElhanney, P. J. McGarry, Major McLaren, J. P. McMillan, A. D. McRae, W. L. MacIlquham, A. M. Narraway, T. S. Nash, L. Nevins, N. J. Ogilvie, H. Parry, W. J. Peaker, Wm. Pearce, J. W. Pierce, T. H. Plunkett, R. C. Purser, G. L. Rainboth, J. L. Rannie, C. Rinfret, F. W. Rice, G. P. Roy, T. Shanks, P. A. Shaver, H. L. Seymour, N. B. Sheppard, G. Simpson, R. L. Squire, J. N. Stinson, P. B. Symes, A. S. Thomas, J. N. Wallace, G. H. Watt, E. J. Wight, E. E. D. Wilson, J. G. Wright, and others.

THE PRESIDENT: I would ask Mr. Henderson, the Secretary-Treasurer, to read the Minutes of the last meeting.

MR. HENDERSON: As the Minutes of the last meeting appear in the Annual Report, I beg to move that the Minutes as recorded in the Annual Report be received and approved.

The motion was seconded by Mr. Narraway, and carried.

PRESIDENT'S ADDRESS.

The President addressed the meeting as follows:

Gentlemen, I think the uppermost thought in all our minds at this opening of the Annual Meeting is that the War, which during four long years overshadowed the world, is at last ended. The end—for, although peace is not yet actually signed, the war itself is over—came more quickly than any of us had dared to hope.

The Dominion Land Surveyors have taken their part, having to their credit more than 150 enlistments, and we must not forget the hundreds of un-named men, who although not surveyors, had yet been members of survey parties all over the West. Of the Dominion Land Surveyors who went to the front many will not return, but their memory will endure, and we must ever remember, even in times of peace, that in a special degree it was to us "they threw the torch, and that we must hold it high." Many also have suffered in a way which must sorely try their lives, and it is the duty of this Association to see that the future well-being of such is assured.

Now, Gentlemen, in these times of change, it seems appropriate that we should take a retrospective glance at the position which our profession has occupied in the past so that we may see more clearly what should be done in the future. If I deal with such a wide subject in a way which is not as practical as some members would wish, my hope is that it may possibly lead some of you to review the attitude which you have taken in regard to this important question.

In taking a general view of our own profession, it seems very necessary to deal more particularly with matters which concern those Dominion Land Surveyors who spend most of their time in the field. The field surveyors must always be the basis of the profession. It is not intended for a moment to undervalue the great importance of the work of those who guide, and co-ordinate, at headquarters. Far from it; but the cardinal characteristics, the outstanding features, which distinguish surveying from other professions, must always come from the field surveyors. It is they who have the power to cast the mould from which succeeding members may take their form.

Yet, look over the reports, not only of this Association, but of other surveyors' associations, and you cannot fail to notice a very general expression, common with all, but especially common with the field men, that their profession is not appreciated by the general public as they think it should be and there is an expression of disappointment that men, who have done the great work which they have done, should not have a better standing and greater recognition. I do not think that there can be any doubt that this feeling is more common amongst surveyors than amongst those in other professions; nor do I think it is by any means groundless.

But, before looking into this matter, it might be well to point out that the idea of appreciation has two separate aspects. One is subjective; that is the feeling of the man that his work should be appreciated, and the other is the objective feeling experienced by others when they regard the man or his work. The first is undoubtedly a weakness, for it is an unconscious confession that the man is taking too personal a view of the real reasons for his work. If he thinks highly of his own work, well and good, but he has no right to complain if the public are not concerned with his view.

The second aspect, however, that is the feeling experienced by the public in regard to the man or his work, is an important one, because the work will not be undertaken at all if its value is not appreciated, and further, because the appreciation of the work may not go far enough to yield a fair recompense to the man who does it. It is certainly a duty to try and persuade the public to get work done, even though the surveyor has to risk the criticism that he is only moved by selfish reasons. Such criticisms have been brought up against every disinterested movement.

Want of appreciation of the value of doing certain work must come either from ignorance of the true conditions, or it may be that, having all the facts, the public deliberately join issue with the surveyor as to its real importance. In either case surveyors have a hard task, and can do little individually. They have only two real weapons. One is the concrete value of the work, which they must have faith will come into its own in time, and the other is the weight of the opinion which the public may assign to each surveyor and to the profession itself.

Now, while waiting for the real value of the work to become apparent, it is very important that surveyors shall seek out the causes which underlie the rank which should be given to a profession and to the men who belong to it. I do not think there is any doubt that the public regard surveyors as members of a second-rate profession. As to the work done, I think they appreciate it highly, but the stumbling block to them seems to be the man himself, and I think the man himself is by no means entirely blameless. It is not meant that each surveyor individually is the cause of this want of appreciation, but that each surveyor seems to have made little effort to combat the source of the weakness of the whole profession.

The current of a surveyor's life sets early in a wrong direction and, either from want of consideration of its dangerous course, or from want of effort to turn into another channel, he allows himself to drift, until at length he too becomes aware of the same weakness, and it is this feeling of weakness which is the source of his disappointment. His work has developed his individuality. Even the most obtuse can see that, and in itself that is good, but before he has become aware of it, this has taken too strong a hold upon him. He has become strengthened in his power to do work alone, but weakened in his hold on what might have given him greater strength than his own, and this source of strength, which he has neglected to foster, is his own profession. He is an individual; better, no doubt, than the average in other professions, but he is not a member of a great profession, which has weight with the public.

We have had many examples of individual self-sacrifice, of hardship endured, and of difficulties overcome, but who will say the surveyor ever gave much thought to any great relation between these things and his profession as a whole? The result is that the work has been done, and done well, but the profession has not received its due, and we are left with isolated work done where we might have had all blended into one great whole.

It is in this that, I think, surveyors have failed in the past. The very nature of their surroundings, and the technical character of their training, have not encouraged them to place much importance on anything but getting the particular work done.

It has been said that surveyors are men who do things, but that is not enough, for in the last analysis a profession can only be great as it affords a field for great principles. The education of surveyors should be broadened. The leaders of other professions—for instance the legal profession—are much more widely-read men than are surveyors. Has this not something to do with the traditions that attach to some of the professions? Is it not significant that if a doctor or a barrister gives up his practice and undertakes some other work he is, at heart, a doctor or a barrister for the rest of his life? But if a surveyor takes up other work, he never mentions the fact that he is surveyor by profession, and he never seems to take any pride in the profession for which he was trained.

Is it not possible that it is here that the public have judged surveyors better than they have judged themselves? The fact is that surveyors have failed to foster those ideals which would have given rank to their profession, and through their profession, to themselves. If a man says he is a surveyor, everyone recognizes he has done a certain class of work, but beyond that, his statement calls up no very definite idea as to any profession in particular. It may be that surveying is more indefinite than other professions, but the main cause is that surveyors have not regarded their profession as something apart from the work in hand. The profession, as a profession, has not grown simply because it has never been fostered.

It is not intended to say there is no fellow feeling, for that exists, but fellow feeling is rather a characteristic of a society than the ideal which should underlie a profession. What is wanting is that we should regard our profession as something to which we owe allegiance, a feeling that much was conferred when we were admitted, and that, therefore, much will be expected, an ideal finely expressed by the old motto—noblesse oblige. Founded in this way, as every profession should be founded, on the thought of its members, it will not be long before its strength becomes manifest.

So much, Gentlemen, for the ideals towards which we should strive. What, now, about the more practical aspects? First of all, we should set our own house in order. We can never gain strength if we are individual surveyors all the year round except at annual meetings. The whole profession should be better organized. It should move with the times. Surveyors have explored and surveyed a great country and it is they, more than any other class, who made it possible for others to follow. Why should they not follow up themselves? It is something like the North-West Mounted Police, an organization whose existence and field of work have been almost identical with our own. For twenty years people have been saying that their day is past; yet to-day they are as useful as ever. The public have found that it is one thing to talk of abolishing a fine organization, and quite another thing to contemplate what would occur if it were abolished.

If the country is growing up, can the surveyors not grow up too? Can organizations which have done admirable work in the past not adapt themselves and do equally admirable work in the future? The men are here. The organizations are here. And surely anyone who has been in the West knows that, in all conscience, there is work enough waiting to be done. But a better organization of the surveyors themselves is urgently needed. We are few in number compared with other professions, and the weight of every one is required. We should broaden our training to meet the requirements of different branches, so that the Association may include surveyors engaged on many different classes of work.

This Association can be made a power in the land because we deal with a vast country in the making. Why should we be small ourselves? Let us stand on the dignity of being members of a profession worthy of that great country which gave our profession its birth.

The address was received with manifestations of approval and the conclusion was marked by an outburst of applause.

At the request of Mr. Wallace the Chair was taken by Mr. J. R. Akins, D.L.S., the Vice-President, who continued to preside throughout the meeting.

Mr. Rannie: I take pleasure in moving a vote of thanks to the President for his very interesting and able address.

Mr. Barber: I would like very much to second that motion and to say that many fine and useful things have been said by Mr. Wallace which it would be well for the members of the Association to think over very earnestly.

Mr. Akins: Mr. Wallace made one remark to the effect that the Association should be made a power in the land. He has not answered the question as to how we are to bring about that result, but I think that every member of the Association should individually think over the matter and endeavour to find a method by which that is going to be accomplished.

The motion was carried unanimously.

Mr. Wallace: I have to thank you for the very kind manner in which you have received my address. If any man thinks that my view is not sufficiently practical, I suggest that he consider his own position. If he comes to the conclusion that it is all right, well and good, but he should not say that this is a practical profession, founded on practical lines, until he has very carefully studied his position. It has not developed the same traditions as the medical, the legal, or other professions. As to the remark of Mr. Akins, there is only one answer, and I tried to bring that out, namely, that the power of any profession must be based on the allegiance of its members to the ideals which should underlie their profession. As our thoughts are, so will our minds be in time, and as we regard our profession, so will it be in time. Each member should realize the responsibility which rests on him to regard his profession as something much greater than himself.

Correspondence

The Chairman: The next order of business is the reading of correspondence.

Mr. Henderson: One of the letters which came during the year was from E. W. Berry, O. Inkster and A. M. Perry, three surveyors at the front, who wished the Association to use its influence at the time of the signing of the armistice to hasten their return to their native land. Writing November 22, from Mons, France, they say in part:

"In the scheme of demobilization it is reported that, among other considerations, priority is to be given to men of certain callings, essential to the immediate progress of Canada. We feel that under present conditions in view of various proposed schemes of settlement of soldiers on farms, etc., that land surveyors should certainly be included in this category. It is not necessary to enlarge upon this point to fellow members of our profession.

'In view of our comparatively small numbers, the membership of our society is well represented in the ranks of the Canadian Corps and other Canadian troops. It has been truly said that this has been largely a war of engineers and mathemeticians. Especially in the Artillery and Engineers, Dominion Land Surveyors have cheerfully rendered such services as their technical ability could provide, even though accorded only the rank of private or N.C.O. This work is now finished and we feel the place where we can best serve Canada at present is at home.

'Trusting to the traditions of our society in the past, we feel that we shall not appeal in vain to members resident in Canada to take such steps as may be necessary to ensure that the interests of their confreres overseas will be brought to the attention of the authorities in compiling the list of trades and professions whose members are entitled to return to Canada first."

A committee was appointed to look into this matter. They interviewed the Militia authorities who said that unless there was a special demand for surveyors, they could not take any action, and, in any case, they could only take action as to certain individuals, and not as to a class; that if the Association would say that there was a great demand in Canada for surveyors and ask for about twenty by name they would see what could be done. The committee then went to the Surveyor General and he expressed the view that it would be deceiving the surveyors and also the Militia Department to say that there was an urgent need for surveyors in Canada just now, and that nothing could be done. This view was conveyed to the gentlemen who wrote the letter and the correspondence ended there.

Mr. Henderson: The next is a letter from Mr. J. A. Buchanan, dated August 8, in the latter part of which he says:

'"I would like to point out, however, what I consider to be a real grievance under the present system, which I feel, even under the present method of appointing outside surveyors, could be considerably relieved through the efforts of the Association, if the matter were placed in the proper light before the Surveyor General and The Minister. This grievance is, that year after year surveyors have been dropped from the staff of the outside service without any notice whatever. I know myself of at least two surveyors, who supposing that they would receive their appointments as usual this season, made their plans accordingly, and who, although they were dropped from the staff, never were given any notice that their services were not required. Any information which they received was of an entirely unofficial nature.

'To have one's sole source of revenue thus cut off so suddenly, without any warning, and without ever having received an official notice of dismissal, is most unpleasant, and more often than not most embarrassing financially. This state of affairs would be remedied if a surveyor were given notice in the fall, after his field work was completed, that his services were no longer needed or desired as the case might be. He would then be given an opportunity to make provision for the future while he was still drawing a salary. All members of the staff would be equally benefited, as they would be relieved of passing through that uncertain period of waiting each spring, during which time each individual surveyor is obliged to await the pleasure of the Department in disposing with his case, knowing that under the present system of dismissal, he can't even surmise what disposition has been made of it until such time as he either receives his instructions, or as a day or two has elapsed since some other surveyor residing in the same district, has received his.

'If notice of dismissals were given, each individual would be in a position to form some definite plans for the future, and although he were included among those dismissed, he would be much better satisfied to have been notified, and would, in all probability, by the time his returns were complete, have benefited considerably by having established himself in a new position along his own line or by having fitted himself to accept some position in the industrial or commercial world. In most cases it seems to have been necessary to have adopted the latter course, as a Dominion Land Surveyor's commission is of little value after the holder of the commission has been dismissed. This feature in itself I consider to be a strong argument in favour of making the change which

I have suggested. A surveyor has been especially educated along the line of surveying, and after having served the Department, in such capacity, for a number of years, if the authorities see fit to dismiss him, I think that he is entitled to any consideration which will assist him to re-establish himself, for at best he will probably be compelled to start at the bottom of an uphill climb in some line of endeavour which is entirely new to him.

'I trust that you will arrange in some way to put this before the Association. I would also appreciate receiving any views you have on the subject and would be glad if you would advise me if any such request, re dismissals, has been made hitherto, as I am one of those members so far from the Association's headquarters, that I am unable to attend their meetings, and for that reason I may be suggesting a change of policy which has already been discussed and dealt with as the Association saw fit."

Mr. Buchanan's letter was sent to the Surveyor-General who replied on October 15th as follows:

"The strength of Mr. Buchanan's argument cannot be denied, but I do not know enough of the plans of the Civil Service Commission for expressing any views. In the Commission's proposed regulations, the rule is laid down that an employee who is discharged is to be re-employed if the work is resumed; if so, that would dispose to a large extent of Mr. Buchanan's grievance. On the other hand, the Commission may adopt some organization that will remove the grievance altogether. Until we know something more of the plans of the Commission, it is premature to express any views."

The Executive then thought that the matter should go to the Civil Service Commission, and I communicated with Dr. Roche, and got the following reply dated December 12:

"I beg to state that our new regulations when approved by the Governor- in-Council provide that priority of employment for season positions shall be given those who had been engaged the preceding season, and whose work had proved satisfactory to the Department. I recognize the force of Mr. Buchanan's statement about the lateness of the notice given to those who are not to be employed, and I think that an improvement might well be made in this respect. When the estimates for the coming Session are being prepared, which usually is during the latter part of the year, and the amount is included for the next season's survey work, the Department should be in a position to pretty well know the number of parties that will be, under such appropriation, sent out the following season. The surveyors then who are intended to make up the parties might be selected, and the other, if there were not positions for all of them, might at that time be notified that their services would not be required. This would be an improvement on the system mentioned by Mr. Buchanan.

I will lay this correspondence before our experts who are now engaged on the classification of the Service, and it is just possible that they may have some recommendation to make which will improve matters even more than the above suggestions."

The following letter was received from Mr. H. L. Seymour, dated Ottawa, Jan. 21, 1919:

"On page 69 of last season's Annual Report in connection with early Quebec surveys the statement appears that "The first Surveyor-General to be appointed was John Collins in 1785."

Dr. Klotz has been good enough to point out to me that this statement is incorrect. From the information he has supplied me, it should has read "*John Collins* was appointed Deputy Surveyor-General in 1785."

The first Surveyor-General of British North America was Samuel Holland. From *Dr. Klotz'* notes and references I gather the following which may be of interest to the members of the Association of Dominion Land Survepors:—

SAMUEL HOLLAND 17—1801 or 1802

Holland seems to have been a native of Canada. He was engaged in making surveys at Louisbourg after its surrender in 1744 where he made the acquaintance of Capt. Simcoe, father of John Graves Simcoe, afterwards Lieutenant-Governor of Upper Canada. In 1758 he was actively associated with General Wolfe, also with Capt. Cook in survey of Lower St. Lawrence. He was Surveyor-General for fifty years—for all of Canada up to 1791 when Canada was divided into Upper and Lower Canada and from 1791 to death Surveyor-General for Lower Canada (Quebec).

Samuel Holland was a member of the first Legislative Council of the Province of Quebec and which met on Monday, 13th August, 1764. At the time of his death, he was a member of the Executive and Legislative Councils. Holland River and Holland Landing are called after him. His nephew, Joseph Bouchette succeeded him as Surveyor-General of Quebec.

Dr. Klotz has also sent me the following which may be of interest to surveyors:

"QUEBEC, SURVEYOR-GENERAL'S OFFICE

7th Dec., 1816.

Jos. Bouchette, Surveyor-General to Henry Goulburn,
Under Secretary of State.

Requests an assistant—ordinary surveyors' can only be considered in general as woodsmen, and not in any degree calculated to afford me the smallest aid in astronomical observations, especially in taking Lunars.' Asks for 'Mr. Bailey half-pay Lieutenant of Marines as an assistant.'

We have wandered some distance since then, but still the surveyors even now lack that respect for their profession which is due to it, so that the public takes them at their own estimate, and puts them on a lower plane than that accorded to other professions."

MR. HENDERSON: During the year the Executive considered that it would be interesting for the annual meeting to have a report from each of the Vice-Presidents on the work that is being done in the several provinces, and I was instructed to write the Vice-Presidents asking them for such reports. The following replies have been received:

REPORT FOR BRITISH COLUMBIA.

J. E. Ross, D.L.S., B.C.L.S.

"Very little doing" pretty closely describes the situation since the war began. The war, however, was not directly responsible for this state of affairs; in fact it might rather be considered a relief inasmuch as more than half of the practising surveyors of the province donned the khaki shortly after the outbreak. The cause can be chiefly attributed to the "bust" in the land boom. Previous to the drop in real estate prices, surveyors were much in demand mostly on townsite and other subdivision work.

The outlook for surveying here at the present time is not bright. All the land suitable for settlement is pretty well surveyed up. The surveying of pre-emption claims held under record is about all the government has undertaken lately. This will not be lasting as pre-emptions are now confined to surveyed lands. Formerly a pre-emptor could stake a claim in any unreserved crown lands, no matter how remote or isolated. This has proved so expensive that the government is now endeavouring to bring about the Community system especially in connection with the rehabilitation of the returned soldiers.

It is probable that there will be some tracts of land yet to be surveyed along the line of the new P. G. E. Ry. and its proposed extension to the Peace River country. There will also be work in mining claims and timber licenses. There has been quite a revival in mining lately. More thorough prospecting and substantial development work has been done in the Interior than ever before. It is also expected that as soon as the transportation problem is solved and reconstruction work begins in the Old Countries the lumbering industry will be in a thriving condition.

The old surveys here, mostly compass work and often carelessly done, have been the cause of much annoyance. Of late, especially since incorporation, much improvement has been made in the work. The requirements for field-notes now almost reach the ideal but the work in the field is not as exact as it should be.

No important legislation affecting surveying has been passed lately. The members of government survey parties are now entitled to the benefits of the Workmen's Compensation Act. One cent a day per man is deducted from the pay.

Immigration is almost at a standstill but a few settlers mostly well-to-do, continue to come in from the Prairies in search of a more congenial climate and less uncertain crop conditions.

REPORT FOR SASKATCHEWAN.

W. M. Stewart, D.L.S., S.L.S.

Survey work during the past year, has consisted chiefly of the survey of new roads and diversions from the regular government road allowances, the surveys for which are made partly by surveyors in the employ of the Provincial Department of Highways and partly by surveyors in private practice. There have also been a limited number of Townsite and farm surveys performed by surveyors in private practice. The surveyors employed by the Railway Companies have been engaged upon Railway Right of Way and Townsite surveys.

For the surveyors in private practice there has been very little general land survey work available and they have had to endeavour to develop work along the lines of Highway and General engineering rather than land surveying. Land Surveying, however, will doubtless come into its own again in the course of a few years when extensive immigration and new developments recommence.

Along the lines of new legislation there is the new Town Planning and Rural Development Act, in connection with which it is expected that the general regulations will soon be issued and the Act put into practice. As the regulations under the Act are not yet issued, however, it is difficult to say just what effect this Act may have upon the Profession.

REPORT FOR MANITOBA.

W. J. Deans, D.L.S., M.L.S.

In compliance with your request in a letter dated November 23rd, 1918, asking me to report on surveying in the Province of Manitoba, I would say that about the beginning of 1913 surveying operations in Manitoba commenced to slacken up and when the war started very few surveyors had any work. For a number of years previous to 1913 many surveyors were busy dividing lands adjoining cities and towns. It has turned out since that many of these subdivisions were far in advance of actual requirements and will in most cases be sufficient to accommodate a much larger population than the most optimistic of us can expect for a number of years, therefore, the surveyors cannot expect any great amount of work of this kind for some time to come.

The Province of Manitoba has generally been regarded by the Canadian people as a grain and cattle country, comparatively few have any idea that it contains within its boundaries vast areas of mineral-bearing rocks which I predict will yield wealth beyond the expectations of the most sanguine.

Before the outbreak of hostilities there was great activity in prospecting and many promising mineral claims were staked out and a few surveyed, considerable development work was done on a number of the claims, but as the war developed the increasing difficulty in securing satisfactory labour compelled the owners to suspend operations until conditions were normal. Now that the war is over and our country has been brought so prominently before the world on account of the valour of our glorious troops, I look for a great flow of capital into the country. Capitalists are bound to invest their money in a country the soldiers of which have shown on so many battlefields their ability to defend themselves against the best trained armies of Europe and who love liberty and order.

There will be an ever increasing amount of surveying in connection with these mining claims and many surveyors will find work at good pay.

There are large areas of timber and pulpwood in the Province which will require to be surveyed, and many water powers to be developed some of which will receive attention of the Provincial Government at an early date, and an effort made to supply the most populous part of the Province with cheap power for manufacturing and transportation purposes.

The monuments of the original survey have disappeared in many of the townships in the Province and as a great deal of land is held by speculators and companies who in all probability will find it to their advantage to sell out on reasonable terms so that the land may be cultivated thereby increasing production and helping to pay our war debts, the boundaries of these lands will require to be defined, thus giving work to the surveyor. We have large tracts of land in the Province which can be reclaimed at a comparatively small outlay and made productive and if the Province continues to grow and settlers to come in at the rate they have been coming in, it will be necessary to start this work at once.

The only surveying done this year in Manitoba under the authority of the Province was the retracement and resurvey of lines in a few townships where the original monuments had disappeared.

Taking everything into consideration it appears to me that the Dominion is on the threshold of a great expansion. Our agricultural resources will be developed faster than ever, our mineral lands will be prospected and many rich mines opened up. Large amounts of capital from the United States will be invested in industries requiring our raw materials.

Surveyors have every reason to look forward to the future with confidence and should be prepared to take their part in the development of our great Dominion not only as surveyors but as good citizens.

REPORT FOR ONTARIO.

J. D. Craig, D.L.S.

Surveying in Ontario has been practically at a standstill for some little time now owing to war restrictions, partly no doubt due to lessened demands for surveys, and partly due to the desire of the government to curtail expenditure wherever possible. It is probable however that the near future will show a considerable increase in survey work in the Province.

The wonderful work done during the war by the transport arms of the various armies has concentrated the attention of all on the value of good roads, and in certain sections of the Province a campaign has been carried on to educate the people as to the necessity of good roads, and to get action from the Government as soon as labour and financial conditions would permit. The cessation of the war, apparently, was the turning point, and it has recently been announced that tenders will be called for the construction of at least one hundred miles of provincial highway.

There is no doubt that this is only the beginning of the good roads movement in Ontario, and particularly for Eastern Ontario. No doubt the experience of New York State will be repeated here. It was found there too that there was considerable difficulty in getting the first road in any particular district, but after that the good results were so apparent that there arose almost at once a general demand for more good roads.

So it appears that the most active branch of the profession in Ontario in the immediate future will be that of road location and construction, and probably with the change to normal peace conditions the resumption of immigration will again cause a demand for a considerable amount of subdivision work.

As far as I have been able to ascertain, there has been no legislation in Ontario during the past year particularly affecting surveyors.

REPORT OF THE SECRETARY TREASURER.

General Meeting.

A General Meeting was called on March 5, 1918, to consider a situation that had arisen in connection with the Soldier Settlement Board. The Secretary-Treasurer, Maj. E. W. Hubbell, submitted his resignation and the present Secretary-Treasurer was appointed in his place.

Executive Meetings.

Of the six members comprising this year's Executive Committee only one, the Secretary-Treasurer, was resident in Ottawa. The other five were either non-residents of Ottawa or men employed during the season in the field. To overcome this situation these absentee officers were asked to appoint proxies to represent them. The Vice-President Mr. Akins, appointed Mr. G. B. Dodge; Mr. Blanchet, appointed Mr. E. M. Dennis; Mr. W. H. Norrish, appointed Mr. C. Engler.

Thirteen meetings of the Executive Committee as so constituted were held, and the members of the several committees were also invited to attend. Mr. Dodge was always appointed Chairman. It may be noted that the President took the ground that the Constitution gave him no authority to depute his powers to anyone, and refused to appoint a proxy.

There were then two alternatives open—to carry on the business of the Association with an Executive as explained above, or to cease operations until a quorum should be obtained on the return of members from the field.

The former, while fully recognized as illegal or at least irregular, was chosen as being more in the interests of the Association, and it is thought that in view of the results of the year's work the Association at this meeting will express its approval of the course taken.

One of the first matters to engage the attention of the Executive was the printing of the Annual Report. Tenders were called for and the work finally placed in the hands of the lowest tendered, The Pattison Print, 370 Bank street. 425 copies were printed at a total cost of $265, or 62.3 cents per copy.

Some consideration was given to drafting By-Laws for the Branch Associations provided for in Clause X which was added to the Constitution at the Annual Meeting in 1918, but later this was dropped and it was decided to draw up a new Constitution and By-Laws for submission to the present Annual Meeting. This Draft was printed and mailed to the members in December with a covering letter asking them for suggestions, and criticism.

Another matter which the Executive took up was the protection of the interests of Dominion Land Surveyors in the event of the transfer of the natural resources to the Provinces. The final result of this was a memorandum setting forth the views of the Association on the question of securing land for settlers in the West. This was addressed to Hon. Arthur Meighen and copies of it sent to other Ministers, to several interested Government Officials and to all members of the Association in good standing.

An innovation has been made in the matter of papers at the Annual Meeting. Mr. F. W. Rice prepared a paper on Land Settlement which has been printed and sent to all the members. During the period devoted to this in the programme instead of having the paper read we will have it discussed by different members in brief speeches, and will also present letters received from members who are unable to attend. This is the method adopted in some other societies and if it proves satisfactory in the case of Mr. Rice's paper the practice can be extended to other papers next year.

Reports.

Four hundred and twenty-five (425) copies of the Annual Report were received, and disposed of as follows:

Members in good standing	127
Complimentary to Honorary Members, Libraries, etc.	38
Advertisers	11
Ontario Land Surveyors' Association	130
Quebec Land Surveyors' Association	1
Saskatchewan Land Surveyors' Association	12
B.C. Land Surveyors' Association	4
Alberta Land Surveyors' Association	6
On hand	96
Total	425

The following reports were received in exchange for our own:

Ontario Land Surveyors' Association	100
Saskatchewan Land Surveyors' Association	25
B.C. Land Surveyors' Association	6
Quebec Land Surveyors' Association	1

Membership.

At the beginning of the year the membership stood as follows:

Honorary members	9
Active members	240

(Of the active members 62 had enlisted for Overseas Service).

During the year three members resigned, three died, and ten new members were received, making a total active membership at the end of the year of 244.

Correspondence.

Circular letters, notices, etc., sent out to members.

Meeting Town Planning, March 18,	39
Notice re change of Secretary-Treasurer	172
Circular letter re fees	109
Draft Constitution and By-Laws with letter	167
F. W. Rice's paper with letter	167
Copy of Memo to Minister re land reclamation	174
Programme for Annual Meeting	162
Total	990

Total of letters received and acknowledged (approx)	300

FINANCIAL STATEMENT.

January 30, 1918 to December 31, 1918.

Receipts.

Balance in bank	\$217.94	
Cash	7.69	
Fees received	330.84	
Advertisements	93.88	
Sale of Annual reports	6.00	
Government grant	125.00	
Sale of dinner tickets	51.00	
Interest	7.54	
		\$839.89

Expenditures.

Caretaker at library	3.00	
Transfer and Express	4.00	
Luncheon at Chateau Laurier	92.50	
Exchange, war tax, small items	2.90	
Reporter	75.00	
Printing and Stationery	34.00	
Printing Annual Report (425)	265.00	
		476.40
Balance		363.49

Assets.

Bank account	\$374.14
Cash	.35
	374.49
Less cheque outstanding	11
	363.49

Audited January 25th, 1919.

(Sgd.) E. M. Dennis.
S. D. Fawcett.

Mr. Rannie: I notice that the Secretary stated that the largest number of letters sent out had been 172, while we have about 249 members. I wonder if the 249 members takes in the number overseas. If so, that would leave 180 members. Does the difference between 180 and 172 represent the number of members who are very far in arrears? or what does it represent?

Mr. Henderson: I think the difference would be made up by the men who are so far in arrears that we really do not count on them although their names are in the books. There is not much use in counting men whose fees are seven or eight year in arrears.

MR. SHANKS: I did not quite get the number of members to whom the annual reports were sent. I take it to be 127. If that is right, there must be quite a difference between that and the number of members who are on the roll.

MR. HENDERSON: 127 is correct.

MR. SHANKS: What is the reason of the discrepancy between that and the number of members on the roll?

MR. HENDERSON: The annual report was not sent to any one who was more than three years in arrears.

MR. SHANKS: I happened to be a member of the Executive a year ago and those who were members of it will remember that we adopted a certain procedure dealing with those who were considerably in arrears. We cut their names off because we thought they were deadheads and that the paying members of the Association should not pay for their indebtedness. I understand that the Executive during the past year has reinstated them in their membership and put them back on the roll. If that is the case I hardly think it is fair to rescind the action of the former executive. We have tried to keep the membership as free as possible, and, in the absence of anything in the Constitution to guide us as to who shall be active members and who shall not be, I think we should adopt some reasonable principle. I am quite in agreement with the idea of the Executive in not sending the annual reports to those who have not paid their fees for a certain number of years. There is another matter to which I should like to refer. There was a general meeting held since the last annual meeting and it seems to me that the Minutes of that meeting should be read at this general meeting and that they should be accepted by the Association. I understand that certain important business was transacted at that general meeting. If that is the case, and if we want to legalize it, we ought to bring it up in the regular way. I do not want to be too critical—perhaps the work of the Executive may be legalized. It seems that there has been some conflict between the President and the other members of the Executive. The Executive meetings were perhaps not properly held and any action they took may not be quite regular, but if this meeting approves of their action in some way or other it may clear up the atmosphere.

THE CHAIRMAN: In regard to the last suggestion of Mr. Shanks, the Secretary's report has referred to the friction between the Council and the President and if his report is accepted by the meeting here I think it would legalize the proceedings.

MR. RANNIE: The work that has been done by the so-called proxy Executive is all included in the Secretary's Minutes of the meetings. I move that the Minutes of the General Meeting be read and approved, or otherwise, by the meeting to-day.

MR. HAWKINS: I have much pleasure in seconding Mr. Rannie's motion—merely for the information of the Association.

The motion being carried, the Secretary read the Minutes as follows:

Minutes of a Special Meeting of the Association held in the Imperial Building, Queen Street, Ottawa, March 5, 1918.

Mr. G. B. Dodge, acting as proxy for the Vice-President, Mr. J. R. Akins, occupied the Chair.

In the absence of the Secretary-Treasurer the meeting agreed to allow Mr. J. Sylvain who had been sent by the Secretary-Treasurer for that purpose to act as Secretary.

Present, 21 members.

At the request of the meeting Mr. Sylvain presented correspondence in connection with the Soldiers' Settlement Board. This was summarized and commented on by W. H. Norrish, D.L.S. Discussion followed.

The Secretary-Treasurer, Major E. W. Hubbell, D.L.S., submitted his resignation.

Moved by G. H. Watt, seconded by G. C. Cowper, that Major Hubbell's resignation be accepted.—Carried.

Moved by J. L. Rannie, seconded by A. M. Narraway, that F. D. Henderson be appointed Secretary-Treasurer to fill the vacancy caused by Major Hubbell's resignation.—Carried.

It was further decided that the new Secretary be instructed to send the following letter to all members of the Association.

> "At a Special Meeting of the Association held in Ottawa on March 5th, Major E. W. Hubell tendered his resignation as Secretary-Treasurer and Mr. F. D. Henderson was requested to act in his place. In future all correspondence in connection with the Association should be addressed to F. D. Henderson, D.L.S., Secretary-Treasurer, Association of D. L. Surveyors, Ottawa."

Moved by C. Engler, seconded by J. M. Coté, that the Secretary be instructed to write Major Hubbell expressing the appreciation of the Association for his services rendered the Association in the past.—Carried.

Mr. Sylvain thanked the Association and stated that the appreciation shown for services rendered by Major Hubbell had been well deserved.

Moved by G. A. Bennett, seconded by C. M. Walker, "that the Executive of the D.L.S. Association explain to the Surveyor General the course of action which last year's executive pursued re the Soldiers' Settlement Act and how the present state of affairs has been the result of what the Association has done, and the Association feels that it should be allowed to suggest part of the personnel of the Survey Committee of the Soldiers' Settlement Board.

Further that the Executive be empowered to take such further action as it deems wise pursuant to any action or otherwise of the Surveyor General."—Carried.

The meeting then adjourned.

THE CHAIRMAN: Are the Minutes satisfactory? Is there any further discussion on the report?

MR. SHANKS: If that is disposed of, I wish to call attention to the fact that this statement of expenditure does not include any amount for the Secretary. It has been the custom in former years to appropriate a certain amount. I wonder if the Executive has taken any action in that matter. I think we ought to make a reasonable appropriation and, if the Executive have not done so, I think it is the duty of this meeting to do so. If it has not been done, our balance on hand is really larger than it should be because we paid our Secretary nothing for 1918, as I understand it.

THE CHAIRMAN: This is an important item which should be considered because there is a great deal of work in connection with the office of Secretary.

MR. DODGE: Some exception is taken to these special meetings and I think it would be better to decide first whether the Minutes of these meetings are confirmed or not.

MR. SHAVER: I move that the Minutes be confirmed.

MR. KING: I beg to second the motion.

Motion agreed to unanimously.

MR. DODGE: The question was raised as to whether the Executive had made any provision for an honorarium to the Secretary-Treasurer. At the last meeting of the Executive that matter was taken up and $75 was voted as an honorarium to the Secretary-Treasurer. That was subsequent to the 31st December so that it would not be shown in the Secretary-Treasurer's report for 1918.

MR. SHANKS: I have much pleasure in moving that the action of the Executive in appropriating an honorarium of $75 for the Secretary-Treasurer be approved.

MR. DODGE: I second that motion.

Motion agreed to unanimously.

MR. RANNIE: At last year's meeting Mr. Dodge and Mr. Shanks indulged in some criticism as to the wisdom of any amount being paid to the Secretary-Treasurer for the work which he had done for the Society. I must confess that while I am in complete accord with their motion, it looks very bad to have them right-about-face as they are doing now in bringing up this motion.

MR. SHANKS: This report is a very good one. My contention is that we should be able to pay our way and pay it well. I said last year that, considering how our membership looked and how economical we were in the publication of the report, if we were going to get value for our money, we should not be too generous in granting $75. But, as I said, a year ago, the prospects were not too rosy, and we had to call a halt. I think we should still call a halt in carrying on the membership roll members who do not pay their fees. If we are going to carry members who do not pay their fees, I want to be put on that list too.

Mr. Dodge: Mr. Shanks has raised a question as to why these reports were sent out to members who had been in arrears for three years. The question was brought up at various Executive meetings and it was decided that, as we would go into that question in preparing the new Constitution and By-Laws, it would be just as well not to raise it for another year.

Mr. Engler: I think the Executive have gained quite a bit of money this year. Last year we were talking about getting behind but this year we have gained. I should like the Secretary to say how much we have gained in the past year.

Mr. Henderson: It is somewhat difficult to say just what we have gained as we are running on a different schedule this year. My report covers to the end of the calendar year, 1918, whereas the last printed report goes to January 30th, 1918. The financial statement in that report shows a balance in the bank of $358.91, and cash on hand, $9.75.

Mr. King: Would the question of the omission of a paper from last year's report came under this heading of business? There was a paper sent to me by Mr. Herriot which was forwarded to the Executive but it did not appear in the report. I wonder if any acknowledgement was sent to Mr. Herriot or any reason for the non-publication of his paper.

Mr. Engler: Mr. Dennis, Chairman of the Publication Committee, is out. I do not remember distinctly about Mr. Herriot's paper although I do know the matter was considered. There was another paper by Mr. Akins on "Chaining the 6th Meridian." That paper had been carried over from the previous year. As our report was already quite large we decided to carry Mr. Akins' paper over to be published at some future time. Somewhat the same considerations apply in the case of Mr. Herriot's paper as it was not read at the meeting last year.

Mr. King: Mr. Herriot's paper was submitted to some one in the office to see whether the matter in it was all right and then the report came back that what it contained could be found in any text book on Astronomy. The point Mr. Herriot raised was that he knew perfectly well that it was in every text book on Astronomy, but it was not a thing that was ordinarily used by surveyors, and he wanted to bring it to the notice of the members of the Association. It seems to me that either he or Mr. Dennis told me that the thing had been shelved by a clerk in the office. I do not know anything about that. I do not know whether Mr. Herriot ever got any acknowledgement or any reason why his paper was not published. I believe that when the Association asks people to send in papers, and when they are good enough to do so, they should be acknowledged.

Mr. Henderson: I think I can say to Mr. King that it was not acknowledged.

Mr. King: That is hardly fair to Mr. Herriot.

Mr. Henderson: Perhaps not, but things were somewhat confused just then and I do not think any slight was intended to Mr. Herriot. It was only a matter that was overlooked.

Mr. Barber: Even at this late date it might be well for the Secretary to write to Mr. Herriot and explain not only why the paper did not appear, but why it was not acknowledged sooner.

Mr. Akins: The Secretary will do that.

It was moved by Mr. Coté, seconded by Mr. Lonergan, that the report of the Secretary-Treasurer be received and adopted.—Carried.

CONSTITUTION AND BY-LAWS.

The meeting then took up the draft of the Constitution and By-Laws which was given a preliminary consideration together with a number of suggested amendments submitted by Mr. Wallace. Mr. Dodge, as Chairman of the committee entrusted with the duty of drafting the new Constitution and By-Laws, fully explained the meaning and purpose of every change proposed. In addition to Mr. Dodge, the discussion was taken part in by Messrs. Wallace, Shanks, Craig, Akins, Lonergan, Shaver, Pierce, Henderson, Hawkins, Currie, and LeBlanc. Having reviewed the Constitution and the By-Laws, up to the 29th article, the meeting adjourned for lunch.

WEDNESDAY AFTERNOON SESSION.

The meeting having been called to order the Chairman asked Mr. F. W. Rice to read a paper on Land Settlement.

LAND SETTLEMENT.

F. W. Rice, D.L.S.

The criticism is made that Dominion Land Surveyors have no interest in the question of Land Settlement in New Zealand and other countries. This criticism would have more weight if we still possessed land in Manitoba, Saskatchewan and Alberta, upon which settlers could commence crop production without the large initial expenditure of money and labour necessary to clear the land and make it ready for the plow, but we have not left any great amount of such lands. There are surveyed but not yet occupied some twenty-six millions acres. Out of this amount the Soldiers' Settlement Board have been able to find only a very limited amount fit for soldier settlement.

What is the matter? The soil is good and the climate not unfavourable. The reason why the greater part of these lands are not suitable for settlement is that they are overgrown with woods. What is the value of the woods? There is some good spruce timber but where the soil is good the trees are usually poplar, willow and scrub, not suitable for lumber or pulp.

The settlement and clearing of similar wooded lands in the Western Provinces is not an experiment. It has been carried out under private enterprise for years. Almost one third of the settled part of Manitoba was originally wooded. About the same proportion was open prairie and the remainder mixed prairie and woods. The surveyors' field notes show that Edmonton was originally situated in the heart of a wooded country. Mr. Lonergan who has watched from year to year the development of settlement around Edmonton has supplied the following information regarding how the clearing has been carried out.

For consideration take the Beaverhills district east of Edmonton. For our purpose the boundaries of this district may be given as follows: On the west, Saskatchewan river, on the east, the township outlines east of range 20 running along the east side of Cooking Lake Forest Reserve, on the north and south, the township outlines running near Bruederheim north of township 55, and Tofield, north of township 50, respectively, containing an area of about eighteen townships and including most of the above Forest Reserve in which there is a little more than two and a half townships.

Along the west side of this district, as it existed before settlement, there extended along the river a strip of park country 6 or 8 miles wide, consisting of mixed prairie and woods. The remainder of this district was covered with willow and poplar, a good deal of which was small, but with some poplar from 6 inches to 15 inches and scattered spruce up to 18 inches in diameter.

In 1904 a fringe of settlers and a few scattered ranchers had moved across the river from Edmonton into the park country. At present all of this district outside of the forest reserve is settled, and about 80% is under cultivation. These wooded farms were not cleared by the axe but principally by repeated fires, which burned over not only the land desired to be cleared but the Forest Reserve as well. The settlers probably employed the only practicable means of clearing these wooded acreas, but while the farm lands were cleared much damage was done in the Forest Reserve. The completeness with which the clearing was carried out by fire is indicated by the repeated attempts of settlers who squat on the burned over Reserve and endeavour to obtain entry. A few of these squatters are actually living on the Reserve at present.

This indicates the danger of allowing lands to be cleared by private enterprise. Not only are the farm lands cleared but timber lands are also burned over. The necessity for placing clearing by fire under organized control appears quite plain.

The homesteaders who cleared the lands in this district, selected their homesteads when there were thousands of vacant quarter-sections available for entry, consisting of prairie and mixed prairie and woods. The principal reason for this is that, in the wooded country there is always sufficient rainfall to ensure a good crop, while in prairie lands there very often is not.

Mr. Wm. Christie, Dominion Land Surveyor, reports a similar state of affairs regarding the country north of Prince Albert. When the 14th base line was run through this district in 1906 all the country from Paddockwood south to Prince Albert was covered with woods, consisting of poplar with some willow and scattered spruce.

Around Paddockwood and southerly the country was homesteaded by men who worked in the lumber camps to the north in winter or on farms to the south in summer, because a living could not at first be made on the homestead. The usual procedure for these homesteaders was to commence by building a shack and clearing with the axe a small garden plot. The remainder of the farm was cleared principally by fire. Crop failure from lack of rain is practically unknown in this district. These two cases illustrate what is taking place in many districts all through the wooded areas of Manitoba, Saskatchewan and Alberta.

Of course all the wooded lands are not cleared by homesteaders who make entry for them. Some of the European peasantry are contented to occupy 160 acres and cultivate 20 acres or less.

The Soldiers' Settlement Board have adopted the policy of improving farms for soldier settlement. Mr. Narraway who has been working on the problem of clearing has written the following remarks regarding this feature of the problem:

"The question of clearing his farm is one that every settler in the western bush land has had to face, before being able to make any appreciable headway in farming. He has at his disposal many different methods of clearing the lands, and in the various districts one sees that each of these methods has been given a trial with results more or less successful in so far as economical clearing is concerned. But those who have had the opportunity of watching this clearing from year to year have observed that one of the chief factors in each of the methods, was that of using fires to burn the bush and the scrub. Sometimes the timber was slashed first, piled and then burned, other times fire guards were made and the fires started in the dry grass between the trunks this killing the trees. In either case the stumps were left to be removed by force or to rot."

Again many of you have travelled through Dominion lands and have watched the same method of clearing carried out by nature, under different circumstances it is true, but still not so different that a comparison cannot be made. I refer to bush fires. The result is the same—the lands being freed from their timber. In many areas where bush fires passed over the country we now see prosperous settlements, and in cases where the settler has cleared by fire we see him cultivating a valuable farm.

Those of you who have taken the trouble to study the course of bush fires in the west, have noted the various stages between fires in green bush and those in brulé. You have seen fine areas of standing timber replaced by brulé and windfall,—you have seen in turn this brulé and windfall removed leaving open or semi-open lands. In other words you have witnessed the clearing of lands by fire.

The effect of the fires on the soil is naturally the next most important point. You have noticed extensive areas of land cleared more or less completely with no appreciable injury to the soil, while in other cases you have seen areas,—in many cases, equally as extensive where humus in the soil has been destroyed, leaving only the mineral soil. The effect on the soil is altogether governed by its dampness at the time of the fire and the amount of ground logs which burn down into it. Fires in dry soil burn the humus almost as thoroughly as the woods, but fires on wet soils pass on doing little or no damage. Nature usually chooses the dry seasons to do its burning and the soil pays the penalty. Could not the fires be arranged to occur when the soils are protected by moisture?

We have reached a time when lands for settlement are urgently required,—a time when available homesteads are not to be had in quantities large enough to satisfy the demand. It seems reasonable that attention be given to improving these Dominion lands, more especially, when the alternative is to purchase lands at a high cost to the country. Where you are faced with the prospect of having to buy lands at say $20 an acre is it not worth examining Dominion lands to see if they cannot be made fit for settlement at a cost not greater than the purchase price? If you are willing to pay $20 to buy lands are you not willing to spend the same amount improving the lands you already own when the value returned is equally as great, and the amount spent for improvements is paid as wages to the men who are to settle upon the lands?

The suggestion which it is desired to make is not that the green bush be burned at the present time, but that those areas which have reached the brule stage be dealt with. This is the stage when the opportunities are greatest for obtaining lands quickly, it is also the stage where the greatest fire danger to adjoining timber prevails. Some idea as to the extent of these brule areas is given by this map. It is not concontended that each red spot on this map represents lands which it is possible to clear economically, but it is claimed that this is a fair indication of what is to be found throughout Dominion lands, and that out of such areas good locations for burning can be chosen.

Up to the present the policy of the Dominion has been to leave clearing and development to individual effort. New Zealand and other countries have made clearing and development a national work.

The following is a summary of the United States Soldiers' Settlement Act as it appeared in draft form on the 2nd December, 1918. Two alternative plans for co-operation of the Federal Government with the other agencies engaged in similar work are embodied in the Act. The main features of these plans are as follows:

The basis of co-operation under the first alternative plan shall be that the state shall provide the land needed for settlement and the United States shall provide the money necessary to meet the expenses of reclamation, subdivision, improvements and equipment, and shall also perform the necessary work and have charge of all settlement work.

The basis of co-operation under the second alternative plan shall be that the Board shall make expenditures for actual payment for the land, for farm improvements, for the purchase of farm implements stock and other necessary equipment.

After the necessary financial plans have been made the Board shall proceed with the work of subdividing land for farms and farm labourers' allotments. The Board may make the necessary improvements on farms or labourers' allotments, or may contract with the applicant to make them. Such improvements are seeding, planting, fencing, erection of dwellings and outbuildings, construction of drains, laterals, etc. The contract between the State or other agency and the United States shall provide for the construction of works for drainage, irrigation, sanitation or other features under the head of "reclamation."

The Board is authorized to secure funds from the United States for loans to approved settlers, each to be secured by a mortgage on the land or upon property purchased.

The land disposed of under this Act shall be sold after due notice. The soldier to be a qualified applicant must be a citizen of the United States, but should any lands not be required for homes for soldiers they may be opened to other citizens of the United States.

Each approved applicant shall enter into a contract, which among other things shall create a mortgage or other effective lien for the payment of the purchase price of the land, the reclamation costs, the farm improvements, or other charges if any. The purchaser must actually occupy the land within six months, and must reside on it for eight months each year for five years, unless prevented by illness. The contract calls for the immediate payment of two per cent. of the sale price of the land including reclamation, and ten per cent. of the cost of farm imporvements. The balance of the cost of the farm and reclamation shall be paid two per cent. each year for four years, and thereafter in annual payments for a period not exceeding forty years, so as to pay the capital sum with interest on deferred payments at the rate of four per cent. per annum. The title shall not pass till full payment is made. The amount due on farm improvements shall be repaid in a period not exceeding twenty years, so as to return the capital sum with interest on deferred payments at four per cent. per annum. The repayment of short time loans advanced for the purchase of farm machinery etc., shall extend over a period not to exceed five years.

The contract shall provide that the purchaser shall cultivate the land, and keep in good order buildings, improvements, etc. In case of the failure of the occupant to carry out any of the above terms the Board shall have the right to cancel the contract.

It is not necessary for us to merely copy the United States or any other country. As a matter of fact conditions in the United States are different from those in Canada but because that country is our nearest neighbour and is a competitor it is well to know what is being done.

In one thing the United States have outstripped us in Canada. They have a definite formulated policy for dealing with unused lands while we, in so far as the wooded lands in Manitoba, Saskatchewan and Alberta are concerned, have not. The safe and logical step which should now be taken appears to be the carrying out of an investigation and stock taking on a comprehensive scale. Last year we made an investigation of the Peace River district to determine the suitability of quarter sections for settlement. What is now necessary is an investigation for determining future policy. If the wooded lands are capable of providing, after development, 50,000 or 200,000 farms, such an investigation should reveal the fact.

There is a wide distinction between crop production and the clearing and preparation of farms. Crop production is a matter of routine. Clearing and preparation involve probelms of engineering and it is here that practically all the failures occur when development is left to individual effort. Where the development of ready made farms has become a national policy an organization is necessary to carry out the work. What have we to offer in this connection? The answer is left to the members of the Association for discussion later.

The next point to consider is, will the surveyed lands which are not fit for immediate settlement be occupied and brought under cultivation if no change is made in the settlement policy. There is no doubt that such lands will all be taken up in the course of time. Will settlement then extend farther into the territory not yet subdivided. There is every reason to believe that in the wooded areas to the north of present settlement there are great possibilities, provided the problem of land settlement is solved.

It is generally considered that from an agricultural standpoint the land along the Hudson Bay Railway has little to offer. The following is an extract from the report of Mr. W. A. Johnston, economic geologist, giving the results of his investigation in 1916:

"In the area immediately along the railway from The Pas to Limestone River, swamp soils occupy approximately 185 miles, or 52.8 per cent. of the total; boulder clay soils 27 miles, or 7.7 per cent.; lake (stoneless) clay soils, 105 miles, or 30.0 per cent.; esker and beach sand soils, 3.5 miles, or 1.0 per cent.; and bedrock outcrop, 28 miles, or 8.0 per cent. This estimate refers only to the belt of land immediately along the railway, but probably forms an approximate estimate of the distribution of the soils in a wider belt along the railway, except that in a wider belt the water areas occupy a part of the surface, which, judging from the maps of the region, is approximately 15 to 20 per cent. of the total area.

The areas which may be regarded as forming agricultural land include an undetermined, but fairly large, part of the swampy areas where the swamp deposits of moss and peat are only 1 to 3 feet in thickness and where drainage is possible, a part of the boulder clay areas where the soil is not too stony for agricultural purposes, and the lake or stoneless clay areas. The lake clay areas, which form the great part of the agricultural land, are most extensive and continuous in the central part of the region, extending for about 100 miles along the railway from about mile 130, near the south end of Setting Lake, to about mile 230, near Armstrong Lake. In this belt, along the railway, about 65 per cent. of the surface is naturally drained clay land, nearly free from stones and with little or no covering of moss. This tract forms part of a larger area in which a considerable part of the surface is occupied by lake clays, and which extends along the railway for about 150 miles from the upper portion of the valley of Metishto River to the valley of Nelson River. The basin in which these clays occur extend northerly to the southern shore of southern Indian Lake and for a considerable distance south of the railway, and is estimated to include an area of upwards of 10,000 square miles.

The soil is somewhat calcareous and contains a considerable proportion of silt and fine sand, which, with the organic matter content, render it somewhat friable. Its highly productive character is evidenced by the luxuriant growth of the natural vegetation.

The soils are practically all timbered, but the trees are for the most part small and are not deeply rooted, hence the land is not difficult to clear.

The meteorological records show that temperatures during the growing season are as favourable at The Pas as at Prince Albert, or at Edmonton, at both of which localities, as is well known, the cereals common to temperate latitudes have been successfully grown for many years. The temperature records of the central part of the region cover only short periods of time, but the fact that garden vegetables have been successfully grown at several points for many years, together with the evidence of comparatively high summer temperature and the large amount of sunshine, owing to the length of summer days, have led those best acquainted with the region to conclude that the central part, extending at least as far as the valley of the Nelson River at Manitou Rapids, is climatically suited for the growth of the hardier cereals."

Regarding summer temperatures of the central part of the region, including the greater part of the "clay belt," the observations of Wm. McInnes show that in 1906 the mean temperatures for July and August, in Burntwood and Grass River Valleys, somewhat exceeded the average for July and August for the past seven years at The Pas and were nearly as high as those at more southerly points in Manitoba in the same year. Mr. Hawkins states that summer frosts are common in this district, but potatoes have been grown successfully where there are a few settlers.

Mr. Wallace: Are these Commissioners of Crown Lands in New Zealand licensed surveyors?

Mr. Rice: I do not know whether they are surveyors or not; I do not think they are but I could not say for certain.

The Chairman called on Mr. Blanchet to read a paper on the Wabiskaw and Beaver River valleys.

WABISKAW AND BEAVER RIVER VALLEYS.

G. H. Blanchet, D.L.S.

An examination of the homestead maps of Alberta and Saskatchewan shows that settlement extends northward from Saskatchewan River to a fairly well defined line. Beyond this line settlements are usually in scattered patches often at a considerable distance from the general settlement.

It might be thought that this line of settlement was controlled by transportation afforded by the railway but this is generally not the case. The line of discouragement has been in most cases the height of land between the watershed of Saskatchewan River and Churchill River in the east and Athabaska River in the west.

The height of land country is usually of moderate elevation, and on account of its distance from the big river valleys its drainage is poor, giving rise to swamps and muskegs; also alluvium is taken from it to enrich the lower lands rather than supplied to it. It is not agricultural land but serves a useful purpose in conserving the water supply for the tributaries of the larger streams.

This area also has often formed a natural fire guard arresting the prairie-forming forces from the south.

Proceeding northward after crossing the height of land area it will usually be found that the country is similar to that lying south of this area, though in a less developed condition. The forest covering is heavier and more areas of poor drainage exist, but these are soil-enriching agents and it will often be found that such land when improved is superior to the more attractive prairie country to the south.

This is the situation of the country drained by Beaver and Wakiskaw rivers. They already support small scattered settlements at points where fires had formed patches of open country and these settlements are apparently prosperous in spite of the distance between them and their markets.

In their undeveloped condition these districts cannot be considered to offer attractions to settlers, but they should be considered one of the sources of agricultural land for the future. Development of such districts can be best encouraged by opening transportation routes in the direction of the main valley, rather than tapping them through the obstacle. Subsidiary routes will naturally follow connecting the settlements with the main trail or railway.

Mr. Shaver: Mr. Rice has dealt very thoroughly with the question of the Government undertaking to clear land in Western Canada. There are one or two things that I would like to mention in connection with that work. I would point out that land which is very wet is not easily cleared by fire, but by making small ditches, or cutting beaver dams down to assist the water to run away quickly in the spring so that the grass gets very dry you can have a spring fire that will do no harm. It will then kill quite a lot of trees and do a much better job. I do not suggest a big drainage scheme but just a small ditch and the cutting out of the beaver dams which a man can do with an axe and a spade. It will give the fire a chance to run down to the edge of the beaver dam and you can tramp away the willows and that sort of thing and extend the clearing. Mr. Rice also spoke of the surveys made in the Peace River country. The classification of lands will be dealt with more thoroughly in a paper that is to follow. However, the settler, as a rule, clears his land by fire. That is the system usually followed in the district northwest of Edmonton. A man will take straw and throw it in a patch of willows. After the grass has been trampled down, or destroyed by cattle, he sets fire to the straw in order to kill the willows and in a short time they die out. The willow is the hardest kind of tree or shrub that you have to deal with in clearing. They have handled it in a comprehensive way, not spending too much on clearing at first. The easy parts are cleared first and as settlers go in, firing is continued to clear other parts. When you once open up the country to traffic you will not have to pay such large subsidies to the railways. If you had settlers along the railways, it would encourage others to come in there and you would get rid of that lonesomeness which makes people want to go to an asylum.

Another matter in connection with settlement is the roads. If roads are opened up as fire guards, they will serve the double purpose of preventing fires from spreading and providing the people with means of transportation. Land is damaged by fall fires whereas in the spring they do no harm.

Mr. LeBlanc then presented a paper on the Fort Vermilion District.

FORT VERMILION DISTRICT.

P. M. H. LeBlanc, D.L.S.

The center of this district comprises three settlements: Fort Vermilion, North Vermilion and Boyer settlements.

Fort Vermilion lies on the south side of the Peace River in townships 108 ranges 12 and 13 west of the fifth meridian; North Vermilion is in the same townships on the north side of the river; Boyer settlement lies in township 109 range 13 on the south side of the Boyer River which empties into the Peace River a few miles below the settlement.

The district is located about 250 miles north of the town of Peace River, and is reached by navigation on Peace River which is the best means of transportation during the summer with the outside world.

Large steamers plying from Peace River provide practically a weekly service to Fort Vermilion and Vermilion Chutes. Peace River flows in a valley two miles in width and from 60 to 250 feet in depth, between sand and gravel bars extending almost across the river but there is generally a deep channel open to navigation.

Several large and wooded islands with exuberant vegetation ornament its surface here and there, causing eddies and whirlpools barely visible at a distance. Where large bends are formed, on alternate sides of the river, fine wide level flats are to be found with probably the richest soil in the northern country, made up of an alluvial deposit of black soil. Some of the lower areas on these flats have been exposed to flooding on rare occasions perhaps once in 10 years. The majority of these points, however, are above the high water mark and when cultivated yield the heaviest crops.

The principal occupied flats are Prairie Point, Lawrence Point, Stony Point, part of Fort Vermilion and North Vermilion settlements, and Beaver Ranch.

At Fort Vermilion the Peace River is very beautiful, of a good width with a current of about five miles an hour at high water and two to three miles at low water. The depth of the river in October, was found to be 34 feet at a point opposite the Hudson's Bay Company's stores.

The whole country adjoining the Valley of the Peace River is an immense plateau extending 25 to 30 miles on both sides of the river and not elevated at its highest point more than 100 feet, the greater part being less than 60 feet above water level.

The fertile land is comparatively level or gently rolling, occasionally broken by the banks of the different rivers and creeks flowing through this district and extends northerly to the height of land and to the Caribou Mountains which are visible from Fort Vermilion, some 40 miles away. These mountains about 2,500 feet above the plains give good protection to the district from the cold winds of the Great Slave Lake. To the south of the river fertile land is found to the foot of the Buffalo Head Hills which are 1,500 feet above the level lands.

The soil is a rich black loam on a clay or sandy clay subsoil. The surface with the exception of a few belts of bush consists of extensive plains of park like nature, bluffs and clumps of poplar with patches of open prairie intervening, or extensive prairie with occasional small poplar scattered here and there.

Small sandy ridges occur only within a few miles from the edge of the valley of the rivers, usually covered with jackpine.

Patches of original forest remain particularly in the river valleys, at the highest elevations and on the slopes of the Buffalo Head Hills; these wooded areas are on the Wabiskaw River, and the timber could easily be floated down that stream to the Peace River. The different varieties of timber are spruce, pine, tamarack, poplar, birch, balsam, cottonwood and willow.

At Fort Vermilion there are two saw mills in operation with planing and shingle machines. All building material required is manufactured locally.

The prairies are immediately available from an agricultural point of view, the regions now covered with second growth and forest where the soil itself is of good quality will eventually be equally valuable. The land is not all suitable for immediate cultivation. It has its swamps, its light muskegs and its low patches of land producing large quantities of hay, but nearly all this district can easily be drained in the different creeks which cross it, running towards the rivers.

Good wagon roads from Fort Vermilion lead southeasterly to Tall Cree Prairie in township 104 range 10, then 20 miles across prairies of very fertile hay production and on to the Wabiskaw River in township 103 range 9, from where pack trails run through the Buffalo Heads Hills and the wild country to Wabiskaw settlement. Southwesterly from Fort Vermilion the roads lead to Stony Point and to Mustus Lake and to the foot of the Buffalo Heads Hills where large prairies are found; a branch of this road is running to the Peace River at a point called The Crest, above the goose neck bend of the river.

A ferry is in operation at Fort Vermilion rendering the crossing of the river very easy and advantageous. On the north side of the river good roads from North Vermilion lead to Lawrence Point and Prairie Point while others run westerly through Boyer settlement and through subdivided country to Aleskay. From this point a good road runs southwesterly to Keg River prairie and then to Peace River crossing. Along this road the land is exceptionally good and many large hay meadows are seen where the settlers of North Vermilion make their annual supply of hay.

From Aleskay another road which crosses the Boyer River leads to Hay River, 75 miles northwesterly; for twenty-five miles the country is the finest wheat land one could wish to get, Buffalo Prairie being a particularly beautiful stretch of country.

The country offers remarkable advantages with its excellent soil of large extent, its early disappearance of snow in the spring together with the long summer days of almost continual light for three months. These are the growing days when vegetation makes remarkable progress thus compensating for the short season.

All this leads one to believe that good crops might be successfully raised in the district.

The temperature during the summer season is very warm, with a sufficient amount of precipitation; the nights are cool and supplemented with heavy dew.

The climate is most salubrious, by all accounts as mild as that of the southern parts of the prairie provinces. Its high latitude 58° 25′ being compensated for by its more western situation, and by its lower elevation. The Peace River is generally open by 1st of May and the ground ready for seeding about the second week of the same month.

Hay making is started about the 15th July, and harvest about the middle of August.

September is unquestionably the best month, the days are still quite warm, but the nights much cooler with the absence of flies.

Winter starts by the end of October and the ice forms on the Peace River by the beginning of November, and is soon strong enough to cross.

Up to Christmas the weather is not excessively cold, the thermometer registering 30° below zero occasionally.

January and February are cold, a temperature from 20° to 60° below zero being experienced.

Snow rarely exceeds 2 feet in depth.

Trapping and hunting are still the main occupation of the Beaver, Slave and Cree Indians and of the Half-Breeds and white settlers in their spare time during the winter months.

Fur trading is the principal trade and is carried out on a large scale by several companies such as the Hudson's Bay Company, Revillon Frères, Peace River Trading and Land Company and others who also have posts at Mikkwa River (formerly Red River), Keg River and Hay River.

Moose, bear, caribou and deer are the larger wild animals, while the small fur bearing animals such as the muskrat, otter, wolverine, beaver, fox (black, red, cross and white) lynx, skunk, marten, mink, rabbit and ermine or weasel, are well distributed and of more paying proposition.

Besides Peace River the district is well watered by streams such as the Wabiskaw, Mikkwa, Boyer and Bear rivers all of which streams are tributaries of Peace River. They contain good water and rise very high with the spring and summer rains. The slopes of the valley though steep are broken by numerous ravines and coulées which afford easy slopes to the river flats.

Good water can also be obtained by digging or boring wells, water being found at from 15 to 20 feet.

The Vermilion chutes situated about 50 miles east of Fort Vermilion were investigated by the Dominion Water Power Branch and the report states "that the river at this site averages one mile in width and takes a drop of 30 feet in a distance of two miles and owing to the irregularity of flow during the year the power development would be in the neighborhood of 27,000 horse power.

At these chutes a company has started boring for oil, they claimed that the prospects of success were very good.

If their expectation is not disappointed their intention is to build a railway at once from Athabaska Landing via Wabiskaw settlement to Fort Vermilion.

Preliminary surveys have already been made to that effect. A Board of Trade has been organized at Fort Vermilion composed of the most influential residents of the community as members.

The Roman Catholic mission in addition to their regular church work conducts a boarding school for the children of the neighbourhood and they have also a number of buildings and cultivated farms.

The Church of England mission conducts two schools, one at Fort Vermilion, and the other at Stony Point seven miles from the first place.

It is reported that 30 years ago forest fires had been running through the country and grass 4 to 5 feet high was seen where muskeg has been and the country was open to the foot of the Buffalo Heads Hills and also some distance north of the river.

During 20 years wheat was produced without failure during that time The Hudson's Bay Company which owns a very extensive establishment built a grist and flour mill which was supplied by wheat grown in the vicinity and during several years the mill was running continually all year round supplying the inhabitants with flour and the surplus was sent to the most remote settlement of the northern wilderness, but for 8 years the grist mill has discontinued operations on account of recent failure in not having a sufficient quantity of wheat.

Sheridan Lawrence who is the most prosperous farmer has an extensive farm and very good buildings, he has had a roller flour mill in operation for several years and flour is made of the wheat grown in the district. This gentleman, together with Mr. Robert Jones who has been in charge of the Dominion Experimental Farm during the past nine years, have made all tests to determine the growing possibilities of the district and the results were very satisfactory.

Settlers are located within 10 miles by 3 miles on both sides of the river and farming has been tried at many places with considerable success. Potatoes, turnips, mangolds, sugar beets, carrots, cabbage, cauliflowers and celery grow well, while tomatoes ripen occasionally.

Flowers are grown with success in the district and many varieties are to be seen blooming in the garden of the experimental farm. If the life of berries and flowers be any indication of freedom of frost this district is well favoured in this respect as the berries ripen here when they are killed in the surrounding country.

Horses, cattle, hogs, and chickens, are plentiful and do exceedingly well; they can be purchased in limited quantities at reasonable prices. Horses and cattle almost invariably winter out well without requiring to be fed; but it is customary to feed them during the very cold weather.

Judging from the climatic condition of Fort Vermilion district as I observed, and from information gathered from pioneers, I venture to say that outside of the immediate vicinity of the river valley, safe crops of all kinds of cereals cannot yearly be expected until the country is entirely opened and cultivated.

This will allow the heat of the sun to penetrate the ground which now remains frozen until late in summer on account of being mostly covered with bush and scrub.

Mixed farming however will always be safe.

I do not doubt that before long this lower Peace River valley will prove further to be exceedingly good in all respects and that it will be only a short time before the whole destrict will be settled with prosperous farmers.

Mr. Henderson: The original paper by Mr. Rice was sent out to the members of the Association with the request that those who wished would reply, sending in their views on the paper. Replies have been received from Messrs. H. Matheson, H. K. Moberly, G. P. Roy, S. Bray and T. H. Plunkett. As Mr. Plunkett is present perhaps he would explain just what his position is in regard to this matter.

Mr. Plunkett: It would perhaps be better for me to read my letter to the Secretary which is as follows:

Letter From T. H. Plunkett, D.L.S.

The question of land settlement for returned soldiers is at present occupying a foremost place in the minds of Canadians, and this particular phase of the settlement question should be considered first.

The soldier desirous of following agriculture is deserving of very special consideration by this country—He has a right to expect very favourable terms and the people of this country, I believe, are strongly in favour of seeing that he gets something from the country worth having —To ask the returned soldiers to do the pioneer work in the large tract of unsettled or sparsely settled land in our Canadian North West is in my opinion out of the question.

One has only to travel through the already prosperous sections of Western Canada to see large tracts of land being held for speculative purposes by companies and individuals. In some places farmers are now holding more land than they are able to cultivate—School lands in some sections are available. In other places a scheme of reclamation would render large areas profitable for farming—Such lands, I think, are proper places to ask soldiers to settle.

A survey of Western Canada by Land Agents and Registrars with a view to determining the extent of land cited above would disclose many excellent farms for war veterans.

Our system of survey of land is to say the least unfortunate when it has to be adapted to the settlement of returned men. The isolated home characteristic of our prairie farms will not appeal to men who for the past four years have become accustomed to commingling—Efforts should be made to evolve a scheme of community settlements where land in sufficiently large areas is available—then, too, where unmarried men are to be suitably settled a community house with a matron and nurse furnished with a library and other attractions would be a distinct incentive to men to remain on the land until such progress had been made in their farming operations that their own ambition would impel them to continue their chosen work and dispense with the necessity of this more or less artificial stimulation. To take men from the abnormal conditions of war life and settle them in solitude on prairie farms without attractive surroundings is bound to end in failure.

Soldiers should be made to feel that the country has a real desire that they may succeed but it must be impressed upon their minds that their own efforts must be the decisive factor. Monetary aid should in due time be repaid by the settler—the credit of the country being employed to render this aid on advantageous terms. Land available for settlement in the more remote districts of our Canadian West is of varied adaptability for farming. This land may be roughly divided into three areas.

First: Land lying north of present settlement and west of Athabaska river.

Second: Land north of present settlement between the Second Meridian and Athabaska river.

Third: Land north of present settlement and east of the Second Meridian.

Great discrimination must be exercised in the inducements offered to settlers in these three divisions.

In large areas of the first division inducements greater than at present exist are not necessary—Farming is not so much in the nature of an experiment here—Successful settlement having already been established west of Lesser Slave lake.

Intending settlers not familiar with the conditions should be induced to develop the country using Peace and Athabaska rivers as frontiers and gradually working east, west and south from the Peace and east, west and north from the Athabaska. This area is by far the most promising from an agricultural viewpoint.

Of the second division I can not speak with first hand knowledge—Its future as a farming district is problematical—Government aid here is necessary—No doubt surveyors who are intimate with this district will be able to say to what extent and along what lines aid should be extended.

Having surveyed the Tenth, Eleventh, Twelfth, Thirteenth, Fourteenth and Seventeenth base lines and adjoining block outlines, I desire to discuss the possibilities of this district.

Drainage here is the first essential and it is on account of the necessity of carrying out this drainage along well defined lines after considerable investigation of available sources of discharge that it would seem a better policy to discourage settlement pending a solution of the drainage problem.

Possibly after drainage had been done it would be found that this country is not adapted to farming—This would not necessarily mean that the expense of the work done would be a loss—Covering this country at present is a growth of small spruce and tamarack which attain no more than a height of ten or twelve feet and a diameter of from three to five inches because of the ice cold water which saturates their roots during the whole summer—Drainage I believe would produce a sturdier growth of forest which in a short time would furnish railway ties and fencing material at least.

In support of this opinion I may describe that section of this country skirting the Pasquia hills—On the easterly edge of these hills the country slopes gradually with sufficient fall to drain off considerable of the surface water. In this district some of the finest merchantable spruce and tamarac is produced, and large quantities have been shipped yearly from Chemong and neighboring stations on the Canadian Northern railway connecting Hudson Bay Junction and the Pas.

On further examination it will be found that as one travels in an easterly direction from the Pasquia hills the timber becomes more and more stunted as the drainage facilities become poorer until on reaching the areas constantly saturated the timber is of the very poor quality characteristic of the major portion of the district.

It must not be supposed, however, that this country presents great drainage problems—Spirit levels which were taken at the time of the base line surveys disclosed a decided slope to almost the entire district. Why then, it will be asked, is there so much swamp and bog? This is accounted for by the presence of moss varying in depth from one to three feet, which acts in the manner of a sponge holding the water in suspension.

Government first aid for this country in my opinion should be extended by choosing one or more small sections of this area and having it properly drained. Experimental stations should then be established and the adaptability of the soil examined.

Were it found that agriculture was feasible the drainage should be extended and partly improved farms made and sold to intending settlers along lines similar to those followed by the Canadian Pacific Railway Company in Alberta.

The railway from Hudson Bay Junction north gives excellent facilities for access to this district. It seems, therefore, unfortunate that productions from this large area should be lost, without some effort being made to reclaim it.

MR. BARBER: I would like to make a very brief comment on one point mentioned in connection with the New Zealand method of clearing land. On page 2 of this "Memorandum on State-Aided Land Settlement in New Zealand and other countries" which has been distributed, I notice, in paragraph 3, that land is "disposed of for cash, or on occupation with the right of purchase or renewable lease for sixty-six years." Personally with the object of forcing idle lands into use and thus making them available for settlement, I am in favour of the taxation of land values. This method has been used to a slight extent in the West by the provincial governments and it is possible it will be extended slightly in the direction of levying a small tax upon idle lands. It is not probable that this method will be adopted by the Dominion Government at the present time. It might be very interesting to note just here the difference between what happened in England and in Denmark between 1875 and 1895. According to Mr. Prothero, the Minister for Agriculture in England, agriculture had got into such a condition of what he called "devastation" that it was necessary for the Government to do something either in the way of fixing the prices of grain or in some other way. During that same period Denmark enjoyed an era of unusual development. The exports of butter from Denmark increased from 30 million kroner in 1885 to 156 million kroner in 1905. One explanation of that remarkable development is that the agricultural classes of Denmark are spoken of as "the most enlightened peasantry in Europe." The soil and climate of Britain are infinitely superior to those of Denmark. The writer of this little book to which I am now referring, states that when on a visit to Denmark he asked Mr. Lange, lecturer on political economy at the famous Dalum Agricultural High School, how the Dane came to secure the use of the soil. And the reply was that undoubtedly the main factor was the existence of the land tax which was levied on rural land in relation to value. As we realize that this method is not likely to be used at the present time by the Dominion Government, I think the next best method is that of leasing the land. I do not know, from reading this pamphlet, with regard to the New Zealand system, whether it means that the rental is fixed, under the lease, for a term of 66 years or not.

MR. RICE: Yes, it is fixed.

MR. BARBER: Well, I think that is a weakness. I shall give the reason why you should not have the leases for 66 years or any other number of years, with option of renewal, without the condition that the rental value shall be fixed from time to time now. If that were done, I think it would be a very good method; indeed, it would seem to me to be a very much more desirable method than that of expropriation.

I see by the paper this morning that it is proposed by the British Government to set aside a certain number of millions of pounds sterling for the establishment of small holdings. That, I think, is unfortunate. I shall just read a short extract from this publication which I hold in my hand about small holdings in England. It says:

"The Small Holdings Act for England and Wales has been in operation for ten years, and its most enthusiastic progenitors would not to-day have the hardihood to deny that it has miserably failed to achieve what was promised of it. Based on land purchase, its first result was to send up the price of land and thus to assure that the small holder would be the slave of the soil. Dotted here and there in the wilderness of the great estates the small holder is isolated and unable to secure the advantage of co-operative efforts, and at every point the scales are weighed against him. The Small Holdings Act of England and Wales has achieved but one good purpose—namely, it has demonstrated in a short space of time the impotency of such methods for the limitation of land monopoply."

I might say that that view is amply confirmed by the report of the Royal Commission on Land both in England and Scotland.

Mr. Wallace: I do not know whether you are familiar with the land system in force in Ireland but it is very much the same as that indicated in paragraph "d" page 7 of the "Memorandum of State-Aided Land Settlement in New Zealand and other countries." In Ireland it is not a case of settling people on new land. The whole country was divided up into huge estates owned by landlords. The Government came between the tenants and the landlords. They established a large land office in Dublin, and, from that office they send out inspectors through the country who report on the value of land. On the basis of their reports the value of the land is fixed. The Government then advances the purchase price to the landlords and collects from the tenants at the rate of 4 per cent. for 49 years. Then, the land becomes the property of the tenant. The Inspector fills up a form showing the value of the land and the annual payments or rent. Then, as each quarter comes around, the farmer simply pays the amount due into the local bank and the Government collects the money. The system may have been changed since I was over there, but that is the system as I knew it. It has been found that many men, who would not pay their rent to the landlords, will pay it readily to the Government.

Mr. S. D. Fawcett: The only difficulty about breaking with the tractor is that the surface of the ground is left very rough, the subsoil is brought up and it is some time before the land can be got into condition suitable for putting in a crop. It requires quite a lot of cultivation. I think the contract price for clearing is $20 per acre.

Dr. Deville: I have listened with a great deal of pleasure to the paper and the remarks which have been made. You will remember that land in Ontario and Quebec was cleared by the axe. I remember that in my younger days I often came to a little clearing of the settler who was just starting. He would have cleared about an acre of land and built his shack and the clearing would be full of stumps and burnt trees, so much so that it would be impossible for him to run a plow. He cultivated the land with a stick and raised a little buckwheat between the stumps. Those pioneers could stand it ,but the present generation want something easier and I do not blame the present generation. Mr. Plunkett was of the opinion that the country east of the 2nd Meridian is not fit for settlement in its present state. I saw a copy of a letter two or three days ago from Mr. Deans, an old surveyor who has been a good deal in that country, saying that all the country north of Lake Winnipeg and Winnipegosis up to Grand Rapids should be subdivided at once, that it is all good for settlement. He says that the land between Gypsumville and Grand Rapids is just as good as the land between Gypsumville and Oak Point. I am a little sceptical. I am rather inclined to think, like Mr. Plunkett, that we had better wait before sending settlers in there.

MR. PLUNKETT: Mr. Deans' opinion of that country may be influenced by the season during which he visited it. In some seasons you can go into that country and get around very easily. But in 1912 I attempted to cross that country, north of Gypsumville, from Waterhen lake to lake Winnipeg. I had read a report by an explorer who said that he had been in there, that it was a splendid country, that there was lots of horse feed and everything promised to be very nice. My experience does not agree with this. I do not think that, taking the average season, settlement is possible in that district.

Extract From Letter by H. Matheson.

There are two problems of land settlement in Canada, viz. the settlement of land held idle by speculators and the settlement of crown lands.

I am convinced that a system of leasehold of land from the Crown, similar to that suggested in California, would be much better than the present system of private ownership, because it would prevent speculation in land and protect the farmers from mortgages. This system should be introduced at once for the present Crown lands.

Although far from perfect, the present system of settlement is fairly satisfactory on the western prairies, especially when the settler has a little capital. The land has only to be broken, and the first crop can be secured in about a year. Road construction is generally not an immediate necessity. In bush country, however, the settlers suffer many hardships. The land must be cleared before it can be cropped, and road construction is a greater problem than on the prairie. In the past the settler was given a lot or quarter section of raw land, just as nature and the forest fires made, except for some lines and monuments left by the surveyors. Here he proceeded to carve out a farm for his grandchildren, and often made considerable progress, if death or the lunatic asylum did not claim him too soon. After performing certain specified duties, he was granted his patent, after which he was often happy if he could sell out to some speculator. To settle with a wife and family under these conditions requires more than ordinary courage, and consequently the country becomes populated largely with bachelors, many of whom never get an opportunity to marry. All these hardships and many others that could be mentioned, are unnecessary and could be avoided. The present system, or lack of system, of settling Crown lands is crude, inefficient and discreditable to a country like Canada.

The policy of granting absolutely unimproved land to the settler should be abandoned. He should get a real farm, with house, stable and some fences, and with at least half the land cleared, freed from stumps and ready for the plow.

The following is a method which I would suggest for clearing and improving large areas. The Government should send out large parties to do the work, under the management of settlement engineers, who would superintendent the land clearing, and the construction of roads, bridges, houses, fences, ditches and other improvements. To prevent the appointment of incompetents, these engineers should qualify by special examination. One man would have charge of a certain area, say a township, and have a number of qualified men as assistants. None of their work would be new, but much of it does not at present belong to any kind of engineering practice. Under scientific management, there would be great opportunities for economical development, since the work would be done on such a large scale under one general management. Men specially qualified for this work cannot yet be obtained. The important thing to do at first is to appoint the best qualified men obtainable, who are scientifically trained and likely to develop the new science to its highest possible standard. I believe that the surveyors come nearer to the desired standard than any other recognized class of engineers, on account of the nature of their present occupations. Most of the engineers who do any of this class of work at present are surveyors. Why then cannot the D.L.S. men be appointed as settlement engineers, and the work thus protected from incompetence at the beginning? The Dominion Land Surveyors have developed their present work to a higher standard than that of any other country, and they secure at least as great an efficiency in its performance as could be secured by any private enterprise. There is no doubt that if their brains, energy and devotion to duty were applied to settlement engineering they would astonish the world by their achievements.

I believe there are great possibilities, yet undeveloped, in scientific land clearing, besides high explosives and other means which are now used when the user has sufficient capital, possible new designs, some yet to be invented, of huge tractors, plows, brush-cutting and other machinery, could be used with great advantage in labour saving and economy. The Government having such large areas to clear, could invest heavily in such machinery, which no settler could afford. Besides the ordinary utilization of timber, there are great possibilities in the economical manufacture of potash, charcoal and other products of distilation, and other commodities from timber products and bye-products now generally considered useless. Surely, with the assistance of modern engineering and scientific skill in the removal and conservation of the timber, the work can be done more economically and efficiently than by the lonely settler with his axe, cross-cut saw and team of oxen.

None but suitable land should be settled. Sufficient attention has not been paid to this in the past. A staff of agricultural experts should be employed to determine the advisability of settling any doubtful districts. When a settlement is decided on, an agricultural director and staff should be sent in immediately to start an experimental station. He should be an experienced graduate of an approved agricultural college. Some of his duties would be to experiment on crops suitable to the district, import improved stock and guaranteed seed grain to supply the settlers. As land clearing operations progress, he should make a detailed report, available to the incoming settlers, of every parcel of land in the district, and the purposes for which the soil is best adapted. He should be a man of some personality, and should meet all incoming settlers, become acquainted with them, give them all the information for which they ask and invite them to call again when they want more. Immediately after settlement, classes should be started by him on elementary farm work, free to all who wish to attend. In this way inexperienced settlers would become real farmers in a short time, and would have some respect and desire for agricultural education. I consider this very important, because when inexperienced homesteaders have to blunder through a long pioneering period with nothing but long distance advice through newspapers and government reports, which they perhaps never read, they are apt to lose all respect for such advice, if they ever had any. When they need help the most is at the beginning of their careers.

H. K. Moberly's Letter of January 11th, 1919.

The present system of surveying the lands appears to be the most suitable to the country as a long narrow farm provides less turns in breaking yet in cross plowing it would be very tedious work. The most of the country to be settled is broken up with sloughs that might cut up a narrow farm in two or more inaccessible pieces whereas in a square farm it is possible to work round the sloughs.

Some of the returned soldiers that were on farms before leaving for the front do not wish to return to the farms as they realize how lonely the farm life is and now wish to live in the Towns and Cities. Group settlements are not advisable as the farmer is not as a rule willing to live close to his neighbor. Owing to the state of politics in this country it would be best if the officials appointed to look after this work were entirely under the control of the Dominion Government.

The land should be transferable to the soldier when all indebtedness to the Government has been paid or a greater portion of it as the soldier must not be placed at a disadvantage to his neighbor who holds his land clear.

The soldier should have as soon as possible a house, stable, and one or two sheds besides his implements, horses, cow, pig and chickens, but the land should be given him at once as that will settle him to a certain extent and then he can find some employment to carry on till the crop is to be harvested.

The larger proportion of soldiers from the west appear to have been boys who were looking for other occupations than labourers such as High School or University students and they will either wish to complete their course or take up some profession or their old positions in large corporations and they should have some assistance along with the men who require the land.

J. A. Carson's Letter of February 3rd, 1919.

We have here such a wide diversity of climates, more so than in any other province, altitudes and soil conditions, as to preclude any definite set of statements applicable to the province as a whole. In the coast district the most valuable tracts of agricultural land lie in the lower mainland and Vancouver Island districts. These tracts may be roughly divided into two classes; First, meadow land and Two, timbered lands. Of the first class practically all has been settled upon, with some exceptions which could not be worked except at great expense. The second class including logged over, partly burnt, as well as virgin forest make up most of the land which is still to be brought under cultivation. Right here I may say that the finest tracts of this class which I have seen in this country, lie along the east coast of Vanvouver Island between Comox and Campbell River, (roughly twenty miles long and from four to ten miles wide). Most of this land is still timbered, being largely held by the Canadian Western Co. From year to year certain parcels of this tract are logged off and are available for settlement which will eventually result in this being one of the finest farming districts to be found on the coast. A tract of lesser size lies on the mainland in the vicinity of Powell River, roughly fifteen miles long by from one to three miles wide. The land here is good but tends to be a little more rolling than the first mentioned tract, which lies across the Gulf of Georgia from it. This land is also largely timbered and is mainly held by Bloedel Stewart and Welch, Straits Logging Co. and the Brooks Scanlon O'Brien Co. In passing it might be well to mention that the climate which these two tracts are subject to is not quite so wet as that of the lower mainland. The third tract comprises scattered areas throughout the lower Fraser Valley too numerous and scattered to be catalogued in a letter.

This land is of course too expensive after being brought under cultivation to be devoted to the growth of grain or other such crops as thrive in this country which require a large area to give an appreciable yield in gross dollars and cents. Its chief value lies in producing small fruits both for home use as well as the prairie market which must increase as the years go on. It will also be largely used for dairying and market gardening. This means that one man will have in from ten to forty acres according to the precise district in which he is located, all the land he can take care of, and at some seasons of the year more than he can conveniently handle. These lands as they now stand in the rough could be acquired very cheaply, but in such a state they are almost useless to the prospective farmer, unless he has considerable money to spend on clearing, and even if he has clearing in this country is a slow and labourious operation to the ordinary individual. The proper way to handle these lands in my estimation, is for a company or the government to clear large tracts at one operation with suitable machinery (donkey, engines, powder, etc.) either after the land is logged off or in conjunction with logging operations. Lands cleared in this way cost from one half to one third what they would by ordinary methods, and after clearing are worth from two hundred to one thousand dollars per acre.

The interior of this province has areas of land available for agriculture, but like the coast none of any consequence available for immediate settlement. Small tracts may be picked out here and there, but most of the readily cultivable land has already been taken up. Certain parts of the interior have timbered areas which are about as difficult to clear as the coastal tracts and could be cleared to advantage in the same manner. In other parts there are considerable areas which with suitable irrigation could be made very valuable. Due to the mountainous nature of this country tracts must of necessity be smaller and more scattered as compared with land such as is found in the prairie provinces. In passing I might remark that there are quite a number of Indian Reserves in this country comprising mostly the best land to be found in the vicinity, in many cases still lying idle, and with no appearent chance of being made use of in the same way as other lands outside Reserves are.

Proper preparation can possibly be carried out to better advantage by the government in this province than in any other part of the Dominion, as it is going to take considerable initial expenditures before the land which is mostly available can be made entirely suitable for settlement.

G. P. Roy's Letter of January 20th, 1919.

My experience in the areas in which I have worked is that on all quarter-sections, even in forest reserves and reserves for the preservation of water supply there were from 10 to 60 and 100 acres of good and easily tillable land. Such homesteads are welcome mostly to all settlers, desirable for many and an absolute condition to others. By seeding hay and peavine in the bush they can raise cattle and sell cord-wood and commercial timber. Ready fuel makes them free of many troubles and making pulp wood is a good trade.

S. Bray's Letter of January 2nd, 1919.

1. There are large tracts of land in Canada held by Railway and other Companies and speculators; a reasonable length of time should be given to place *bona fide* settlers of approved classes on the lands, say four years. All vacant lands so held at the end of that term to revert to the State, on repayment by the State of the cost of the original purchase money. In cases of donation by the State without purchase the lands should revert at a fixed price, not greater than $2.50 per acre.

2. No Corporation, Company or individual should be allowed to hold more than two sections of land. If greater areas are required, these to be obtained by special charter, specifying the purpose for which they are required and to revert to the State when no longer required for that purpose.

3. Large farms employing a number of labourers should be discouraged. The evils of such a system are well known and the lot of the labourers' children and their future prospects are especially to be deplored.

The Chairman announced that the question of land classification would be dealt with in brief papers by three members, Messrs. L. Brenot, S. D. Fawcett and T. A. McElhanney.

CLASSIFICATION OF LANDS.

L. Brenot, D.L.S.

The classification of lands for soldiers' settlement which has been inaugurated recently has filled a long felt want in connection with colonization. Not only will this classification be beneficient to our brave soldiers who deserve every consideration that we might be able to bestow upon them, but it will materially help to successfully place the future immigration which is certain to come to this country, upon lands which will have been determined by capable surveyors, as desirable for settlement.

The classification of lands will remove the grievance which has so long existed. Prospective settlers will no longer need to search for desirable lands in unknown districts, and as has too often been the case, return disappointed.

It was apparent that previous to the successful undertaking of any settlement scheme the land under consideration would have to be examined and classified by experts, who by their experience were fitted for this particular work.

Two parties from the Topographical Surveys Branch, each consisting of a chief, three D.L.S. assistants, a draughtsman, a cook and two packers were assigned to these surveys. The transport equipment was necessarily a mixed wagon and pack horse outfit. I may state that the work consisted, not of searching out suitable lands for soldiers' settlement, but of classifying those already reserved for this purpose. As the nature of this work was a departure from the ordinary mode of survey the method employed in securing the desired information was left to the discretion of the surveyors detailed for this work.

It consisted of making soil and topographic surveys by which the lands were classified. All important features such as streams, hills, valleys, roads and their conditions, open, brush or timbered lands as well as buildings, fences, etc., were sketched in special field books which were printed for these surveys. Also a complete report made on matters of interest pertaining thereto. With such information an agriculturist can easily determine the value of such lands.

The important feature of the special field book was the cross-section paper used for the pages of field notes, these were of such a size that when the book was opened out, a section would occupy both pages, half a section to each. For convenience on the field and to avoid confusion later, the top of the page was always considered North and the notes taken that way. I may mention here, that the page of cross-section paper was found so convenient for sketching topography, entering notes, etc., that I believe it could be adopted to advantage in the field books for subdivision surveys.

INSTRUMENTS AND METHODS OF FIELD WORK.

As a base to work from, previous to leaving for the field the surveyors obtained plans of all recorded surveys and the standing of the lands thereon. For procuring the information required to classify the average lands, a traverse along at least one side of each quarter section was made, either by running along section lines, or through the centre of the section. It was not the intention in running these lines that any openings be made as it was only necessary that a fairly accurate course be kept. Generally the surveyor examined two tiers of sections on the same day, traversing his line in the one tier on the way out, through a certain number of sections considered as sufficient work for half a day, and then the line parallel and one mile over in the other tier, on his way back, thereby enabling him to commence and end his days' work at or near camp. If the country traversed is found suitable either for immediate settlement or for some reclamation project, more time should be spent and the examination extended, in order to obtain full information for the development of such work, particularly in the case of lands with good soil covered with brule and windfall, which might be cleared advantageously by controlled fires.

The course of the line run was kept by compass, aided where possible by sighting on distinctive topographical features. Generally a mile was travelled with but 2° or 3° of angular swing.

Distances were measured by pacing, a Tally Register being used to keep account of the number of paces, and this was found an excellent method of measurement. The number of paces for a distance of half a mile naturally vary with different men, but this can easily be determined by pacing over a measured distance, at a natural gait. Johnson's "Surveying" P. 139 says that when a man's gait has been standardized and on the work he walks at a constant rate "distance can be determined to within 2% of the truth." That refers, without doubt to open land, but in woods' work, errors up to 5% is the usual standard of work.

Approximate differences of elevation were ascertained with the aid of an aneroid, and were reduced to a common datum by refering the observed elevation to some known elevation, such as a railway station, or any other point where levels have been taken.

Test pits for ascertaining the depth and kind of soils, which were described in accordance with clauses 261 to 276 of the Manual of Instructions for Dominion Land Surveyors, were taken as frequently as was necessary to determine every change thereof. A boy's axe was used for this purpose and found to be very convenient. In addition to the above instruments, a camera, preferably a 3A kodak, is essential for this work, for, not only would photographs help the prospective settler to form a fair idea of the country in which he might wish to locate, but they are conclusive evidence.

Topography sheets and a sketch showing classification of lands, together with detailed reports, are prepared in the field and should form part of the preliminary returns.

METHODS OF CLASSIFYING LANDS.

Different kinds of soils are picked by their physical appearance and not by the analysis of samples. The growth of vegetation, or the crops raised in the vicinity are generally indicative of the productiveness of the soil. Samples for analysis should be taken from representative areas. Special reference should be made as to the condition of the soil in fire-swept areas.

The field notes should contain all the information that can be conveniently collected. For each section there should be shown:—the lines traversed by the surveyors; the position of the test pits and the kind of soil found; the position, form and approximate location of all bodies of water, marshes, etc.; the extent of prairie openings and of timbered areas, with the estimated cost per acre for clearing and rendering suitable for cultivation; the position of roads or trails, also all improvements found on lands examined.

The classification is made under the following nine heads and indicated in the field books by respective numbers.

(1) Lands disposed of.
(2) Lands suitable for immediate settlement.
(3) Lands considered fair for settlement.
(4) Lands which can be economically improved.

(5) Lands with suitable soil requiring extensive improvements.
(6) Hay meadows.
(7) Rough lands on which grazing is possible.
(8) Worthless land.
(9) Water areas.

It was important that the surveyor should bear in mind when assigning a class to a quarter section, that this information would be used chiefly by the land seeker to help him to form an idea of what he might expect to find. He is the most interested party and would judge the value of the surveyor's work according to his own findings on any particular homestead which he might examine.

In order to show that the surveyor's judgment in classifying lands, agrees favourably with that of the settler, I will cite a case which came to my notice recently. In a township which was classified in the early part of last season, six returned soldiers subsequently located. While compiling the results of our investigations it was necessary, in order to have all the information up to date, that the standing of the lands should be examined. Upon comparison it was found that of the above quarters which had been filed on, three had been classified as suitable for immediate settlement, two as fair and one that might be economically improved.

The opinion has been expressed that the classification might be made from existing records of surveys. This information although sufficient for the purpose for which it was intended, was not taken with any special reference to future uses to which the land might have been put, and consequently are too meagre for a detailed classification such as is now being made.

MAPS AND PLANS.

The index map which has been compiled, is recognized as the crowning feature of the work, by all who are conversant with the needs of intending settlers.

This map which is of great importance and urgently required and for which there will doubtless be a wide demand, has been prepared on a scale of three miles to an inch, to be reduced to four miles to an inch for printing. Quarter sections disposed of are shown in white; those suitable for immediate settlement are in the most outstanding colors on the map, red; lands considered only fair, in mauve; those which might be economically improved, orange; hay meadows in yellow; lands requiring extensive improvements, in green; grazing lands, in hatched yellow; worthless lands, in brown; and water areas, in blue.

Such a map takes from the settler, the onus of searching the country for suitable lands. He can tell at a glance districts which offer some inducements, and need not waste time and money visiting lands known to be undesirable.

In addition to this index map, plans of each township are being compiled, showing in detail the information obtained while carrying on the surveys for classification purposes. Also a plan showing lands with good soil covered by extensive brule, which can be rendered available for settlement in the near future.

Such details, in addition to imparting valuable information to intending settlers, renders feasible the choosing of favourable localities for the development of reclamation projects.

COST OF SURVEYS.

Some 16,500 quarter sections or 2,640,000 acres were examined and classified by the two parties previously mentioned at a cost of a little less than one cent per acre, this includes time spent at office work compiling the returns.

Although the results of this investigation showed that only some 400 quarter sections, or 2% of the lands examined, could be recommended for immediate settlement, it also established the fact that the greatest portion of this area contains excellent agricultural lands, large portions of which can be rendered fit for settlement with very little reclamation work, and at a very small expenditure, and which would furnish large numbers of homesteads equal to much of the prairie land already settled upon.

The results obtained at so moderate a cost, warrant a continuation of these investigations for all Dominion lands in the three Western Provinces, and proper maps made in order to meet the demands which will be made upon the Government in the next few years by returned soldiers and other prospective settlers.

A more elaborate system of classification surveys for assessment purposes has been carried on to some extent in the California fruit and farm lands. In California the type of soil is the most important consideration in fixing land values; yet heretofore it has been taken into consideration by the assesors only in a very indefinite way, if at all. In many cases the same type of soil at one end of a country is assessed twice as much as at the other, even though at the same distance from a market; in other cases all the lands of a certain district are assessed at the same rate, even though certain soils there may be worth five times as much as others. The inequalities shown up have been so great that the State Tax Commission recommended to the legislature to adopt a bill providing that the counties classify their lands under state supervision.

The field work here is done by compass and pacing surveys. For taking topography, a traverse plane table is used, the examiner usually goes along the "forty" lines covering a strip of 660 feet on each side and plots the position of all required objects accurately, pacing for side shots if necessary. Maps showing all important topographic features and soil acreages are made in pencil on the field, from which the finished maps are traced on white paper with colored inks.

The actual cost of the completed maps has ranged from about three cents an acre for cultivated lands to a maximum of six cents. The office work has cost almost as much as the field work.

The Canadian Pacific and the Canadian Northern Railways have made investigations somewhat similar to our classification surveys, for the purpose of classifying and valuating, prior to disposing of some of their lands, although these had been surveyed in the usual way by our surveyors. So if sufficient reasons existed for their doing so, the same reasons exist for the Government to take an inventory of all its available lands.

Such further investigations would reveal the amount of lands available for immediate settlement, the large areas that could easily be improved and the most practical methods for making the necessary improvements.

It is noted from occasional newspaper articles that it is the intention of the Government to purchase alienated lands in the vicinity of railroads, for the purpose of settlement. As is well known, only a certain portion of these lands are suitable for immediate settlement. It might also be advisable to carry on these investigations in such districts.

In conclusion I may say that maps such as previously described are valuable for many purposes. They would furnish information to prospective settlers and buyers of land, and would retard to some extent the promotion of fraudulent colonization schemes. They would be of use to the Dominion Government, for the Soldiers' Settlement Board, the Seed and Grain Branch and to banks in making loans. For the development of reclamation projects, these maps would be invaluable. They would also afford a means of computing the prospective revenues of a proposed railroad and the future possibilities. Many such projects which have failed of promotion might have succeeded had they been accompanied by maps as complete as those described here.

PAPER ON LAND CLASSIFICATION.

S. D. Fawcett, D.L.S.

Mr. Brenot has covered the ground very thoroughly and I agree with him that a classification of available lands is necessary and that the need of such a classification should be fully recognized by this Association and that Dominion Land Surveyors are quite qualified for this purpose. Merchants take stock to find out their standing and as farm lands form an integral part of Canada's resources why should the Government not take stock of these resources?

A surveyor's judgment will be accepted when he says a particular township is too heavily wooded for economic settlement. Almost any intending settler will accept that statement. This will save the settler considerable useless expenditure caused by heartrending roamings through districts where all the information he formerly obtained was from the land office where he was furnished with a sheet on which a lot of x's were marked to guide him in locating a homestead. This method cannot be too strongly condemned and if our investigations have done no more than save many prospective settlers these expensive "wild goose" chases then we are quite satisfied with our endeavours.

The intending settler should be able to go to a land office where he could see an index map prepared in colours and from which he could pick out his locality. This index map should be reinforced by township maps an a large scale where important features such as soil, creeks, openings, etc., would be shown for each ¼ section. With this information in his possession it is conceivable to my mind that he will not lose much time or money in locating himself.

PAPER ON LAND CLASSIFICATION.

T. A. McElhanney, D.L.S.

The results of the examination and classification of land carried on by the two parties in the Peace River country last summer, while not showing any very great extent of land ready for immediate settlement, was nevertheless of very great value in getting information of a reliable nature for this purpose and also a great deal of data which can be used immediately in developing plans for bringing some fairly desirable lands into use and for dealing with or reserving the balance of the land for the purpose for which it is best suited.

One of the points learned this summer of most interest to a surveyor is the fact of the insufficiency of the data obtained on survey for the purposes of a proper classification of land. A surveyor's chief objective has been accuracy and economy of surveys. Data of an engineering or economic nature was of secondary importance and visions of future development didn't haunt him. A further fact in this connection is that a great deal of valuable information has been collected by the surveyor but is not prepared in convenient form for use by the public. I refer to the fact that the data on our township plans, outside of that relating to measurements, is insufficient for any accurate idea of the suitability of the country for settlement. When the surveyor's field notes were made up, he hadn't in view so much the recording of information sufficient for an accurate land classification as he did the return of field notes of high accuracy in measurement. In a classification of part of a township from a field book when an examination had not been made by us on the ground, the following results were obtained. Of 43 quarter-sections examined from the field-books 21 were considered too heavily timbered for settlement, 8 might be economically improved, 4 were considered fair for settlement, and 10 suitable. By looking up the disposal sheets it was found that the whole 43 were already taken up. This case is probably rather unusual but we have tested some very good notes taken recently in country we examined and found a very great difference in classification made on the ground and from the surveyor's field notes. The field notes have not been made with land classification in view and while reliable so far as they go are insufficient for a comprehensive classification.

I think that every surveyor engaged in this work was impressed with the fact of the need for better information maps. It has not been the practice on most Dominion Land Surveys to get sufficient information for plotting continuous topography and divisions of different classes of land. From a settler's standpoint and also for any land development projects this is of more interest than the mathematical accuracy of the survey.

The surveyor is the "pioneer engineer." He comes between the wilderness and settlement. There is little preparation made for settlement of land outside of the work of the surveyor or little information to present to him outside of the surveyor's report. Right here we have come to the most striking problem for the surveyor emphasized by last summer's work. I refer to the problem of the surveyor's relation to land settlement. It has been very aptly said that a locating engineer on a railway is the "architect of destiny." Can we not very appropriately apply this term to the surveyor with relation to land settlement. When a survey is completed and made an official survey, the boundaries laid down might almost be called "boundaries in perpetuity." If a farmer, following a road allowance, hauls sufficient loads over that road to make a good track over a hill the chances are pretty good that he will continue to haul loads over there as long as that hill lies between him and his market without thought that the road might run in a different place. The road which follows some of our road allowances displays less engineering economy than a cow-trail across a coulee. I have in mind a piece of road. A creek about sixty feet wide and in a valley about 70 feet deep runs in a westerly direction crossing a road twelve times in 2½ miles. The creek swings far enough from the road so that when it is crossed it is necessary to climb over the nose of a hill to get down to the next crossing. Each of these crossings requires a good bridge, generally a steel one. Similar inconsistencies were encountered last summer. So many of our road allowances fall in country which is entirely unsuited for roads and which make no connection with any fenced road system that there will nearly always be a portion of our road system held out of use.

The training in land classification has had a tendency to relate more closely the two problems of land development and survey. A surveyor is laying down the frame-work for land settlement but too often it has been approached merely as a matter of survey without studying the relation between survey and settlement. Agricultural methods are changing very rapidly with the increased use of mechanical power and more scientific methods of agriculture will require more scientific consideration in survey for settlement. Good roads will be a very strong factor in land values soon and good roads require grades according to contour.

The study of the relation of the surveyor to land settlement brings into consideration the question as to whether our present fixed system of survey is the one which should be continued or whether something more elastic should be substituted. This is too large a question to deal with in this connection. It does seem to me that it is one which deserves very serious consideration at the present time by Dominion Land Surveyors and also provincial surveyors.

The examination and classification of land has opened up a side of surveying that was formerly more or less closed to the surveyor. I refer to the economic side. A surveyor hitherto has had little occasion to consider value or to take any particular interest in the problems of settlement. Our costs of survey have largely been estimated as cost per mile. The value of land and cost of clearing land is estimated in "per acre" terms and for the purpose of comparison it might be well to see what our survey costs per acre. In country similar to the Peace River country, the field cost of surveys would run from about 10 to 20 cents per acre. The surveys on the prairie would be only a fraction of this probably under five cents. The cost of the field work in connection with land classification last summer was about one cent per acre. If a man qualified to classify land and to make a contour topographical map had been attached to each party making subdivisions it would have raised the cost by about 2 cents per acre. I mention these figures to show how small the cost of survey is in relation to the value of the land. In its connection with land settlement it is insignificant when we consider the permanent effects of the survey on future settlement. I think therefore that in considering survey with relation to settlement that the actual cost of the survey should be no obstacle in considering the best methods of dividing up land for successful settlement.

We ask ourselves then what is the present job before the Dominion Land Surveyors' Association in connection with land settlement. We have a mass of good information with regard to settlement, I mean reliable in a general way. This should be put in shape for public use and before it is put in use it should be supplemented by an investigation for land classification and topography. These two factors control land development. The larger problem growing out of this, viz,, the revision of our method of surveys in places, should engage the attention of every surveyor who has an interest not only in land settlement but in the future of his profession.

Mr. Shaver: I would like to say a word about the note-book we had last summer. The leaves were divided into one-tenth inch squares each representing a chain, so that the topography could be noted very quickly and there was no guess work about it. A section, or quarter section, can be entered quite accurately and with very little difficulty. It is a big improvement on the note-book with plain paper.

I would like also to say a word in praise of the little ticker, or tally. It is wonderful how accurately you can use that instrument without its diverting your attention from your work. It is something that should have a place in the equipment of every surveyor in the field. At first you have to watch it a little and see, as you go ahead, that your thumb keeps moving and you must notice whether it is registering; but after you become accustomed to it, you find that it does not take your attention from your work. When you come to a place at which you have to make a diversion, you stop it, as for instance, going round the end of the lake, or other obstruction, and when you regain a point from which you are to continue in the direction that you are supposed to follow, you start it again. Even when making considerable diversion, or going around large obstacles, I have often come very close to the exact distance, in a straight line close to the post. At first it did not look very practicable but before long I found it a very efficient instrument.

Mr. Pierce: I had, perhaps you will say, the misfortune to have to do some of this work myself towards the end of the season when our party were expecting to go home. We were called upon to carry on some investigation in some of the forest reserves in Manitoba with the idea of discovering the value of some of this land for settlement. One important and necessary part of the work was to investigate the progress that had been made by settlers in the adjoining settled districts where the climatic and soil conditions were identical, as far as we could ascertain with those of the country we were called upon to examine. Mr. Christie and I found in a great many places that prosperous settlements had been developed right up to the boundary of the reserve. Looking along one side of the reserve, we saw prosperous farms, good houses, roads built up to the reserve-line, telephone, rural mail route and, in one or two cases, farms equipped with electric light. Surveyors, perhaps, in the past, have not paid very much attention to soil valuation, the chemical analysis of soil and things like that, and it is possible that an examination of soil carried out by surveyors would not be of very much value. Still, after talking to these farmers across the line, looking at their improvements and comparing the soil they were cultivating with the soil across the road, we came to the conclusion that we could judge pretty well as to whether the land across in the reserve was going to be of any use or not.

Mr. Shaver has told us about those little tickers, as he calls them. He says that they are automatic and that you just walk along and never know you are using them. That is true, but when cold weather comes, they are pretty cold in the hands. Some of our assistants omitted to use them and paced without them, but we could not notice any difference in the work. In cold weather it is very inconvenient to use them. I would like to mention another little thing that we used in connection with investigating the soil. Mr. Christie and myself were instructed to take samples of the soil. During a part of our investigation there was frost in the ground and the only way to get down through the frost was with an axe. We found by using a little hatchet we could get down through the ground. We found also that by using a little spade, or trowel, five or six inches long, once we got through the frost, we could dig down as deeply as necessary. The unfortunate part of it however is that this little tool is not strong enough for general use.

Mr. Shaver: I would like to say another word in connection with the ticker in cold weather. There is a ring on the back of the instrument through which I slip my little finger and I hold it between that and my thumb. Then I use the index finger of my left hand to press the little handle to make it register. I can use it with my mitt on and I do not suffer from the cold.

The session was adjourned until 8 p.m.

EVENING SESSION.

The meeting resumed at 8.15 o'clock, with Mr. Akins in the Chair.

Mr. Akins: We are to be favoured to-night with an illustrated paper on "The Possibilities of the Aeroplane in Surveying," by Mr. R. F. Clarke, M.C. Without any further preliminaries, I now have much pleasure in calling upon Mr. Clarke.

POSSIBILITIES OF THE AEROPLANE IN SURVEYING.

R. F. Clarke, M.C., D.L.S.

The subject which this paper is to consider was first brought to my notice in France during the spring 1917. The unit to which I belonged, the 3rd Tunnelling Company, Canadian Engineers, was then responsible for the mining operations on the front from the Douve River near Messines south past Ploegsteert Wood to the Lys River. A shaft was being sunk near Seaforth Farm with the object of laying mines under Petite Douve Farm, a German strongpoint just across the Douve stream. The only means of determining the location of this part of the enemy field works and therefore the course of our projected gallery was to make a map of this section of our own and the enemy trenches from aerial photographs. As I had been doing some other surveying for the unit at that time, this task fell to me. Naturally, the possibility then occurred to me of utilizing aerial photographs for determining the topography of fairly level sections of our own country.

When I returned to Canada last year I discussed this method with some members of this association and upon the suggestion of Mr. Norrish, I believe, I was asked to prepare a paper on the subject for the annual meeting this year.

I wish to express my indebtedness to Lt.-Col. Cull, D.S.O., Royal Air Force, until recently Director of the Royal Canadian Naval Air Force, for much of the information contained in this paper. Col. Cull has kindly explained numerous points, and has permitted me, with the consent of Mr. Ogilvie, to use information from a lecture given by the former in Carnegie Public Library on December 23rd, 1918, under the auspices of the Geodetic Society of Canada. I am also indebted to Mr. Ogilvie for the use of the lantern slides prepared for that occasion and now the property of the Geodetic Survey. Dr. E. Deville, the Surveyor General, has been very kind in discussing the subject with me and in giving me information and suggestions. I also wish to express my thanks to Major McLaurin, D.S.C. of the Royal Air Force for reading over and correcting the portion of this paper dealing with aeronautics and for numerous valuable suggestions on the subject.

I propose to divide the paper into three general sections as follows:—

1st—Aeronautics, i.e. the possibilities and limitations of the aeroplane for this kind of work and also the question of cost.

2nd—Aerial photography.

3rd—The application of photographs from aeroplanes to surveying.

Let us consider the flying part of the subject first then.

The aeroplane, needless to say, is a heavier than air machine, in contra distinction to what is called the air-ship, a lighter than air craft. My discussion will be almost entirely concerned with the former means of flying. You are all familiar with the development of the aeroplane, since this development has been almost entirely a matter of the last decade or so.

The aeroplane should be considered in two parts, the motor, and the structure, consisting of wings, fusilage and tail, which carries the motor. What is termed the life, i.e. the period of flying time during which service is dependable is different for these two parts, although it is comparatively short in both cases, owing to the severe strain flying involves, to the vibration and racking produced by the motor, and to the necessity for a minimum of weight, and at the same time for a high degree of dependability, since the life of the aviator depends upon no failure in his machine.

The life of the motor naturally depends very much upon the quality of the make, and upon the care the pilot takes of it. In war service engines receive a great deal of abuse and consequently are quickly worn out. Motors of first class manufacture such as the "Rolls-Royce," "Renault-merc," and "Liberty," may be depended upon for 100 hours at least, and frequently as much as 150 hours of flying. At the end of that time they must be overhauled and parts of greatest wear renewed, at an expense of about 10% of the original cost of the motor. It is then good for another 100 hours or more, when it must be overhauled again. Under war conditions, largely owing to lack of labor for repairing, motors were usually discarded after the 2nd or 3rd overhaul. However, there is no reason why under peace conditions the life of the body of the motor should not be practically indefinite, with overhauls every 100 hours for minor repairs. It is safe to assume, even allowing for accidents, that the average life of the engine would be more than 500 hours, representing a cost of 140% of the original price.

Planes may be equipped with various devices for landing purposes, depending upon the nature of the surface upon which they are intended to land. When they are mounted on wheels, a good, level, open piece of ground is required. In winter these wheels may be replaced, or associated with skids for landing on ice or snow. Machines of the above types are properly called aeroplanes, although I have used that term to cover all heavier than air machines. The aeroplanes have light pontoons or floats which support them on water. Owing to the special conditions of weight and balance seaplanes must be designed throughout their whole structure for that purpose, and therefore floats are not interchangeable with wheels on the same machine. Seaplanes are undoubtedly the best adapted for the northern part of this country, where lakes and rivers are so numerous. For the purpose of landing on a surface surrounded by trees 50 to 60 feet high, an open run of at least 300 yards into the wind is required. In case of engine trouble a machine can plane a distance about five times its own height, i.e. with a height of 10,000 feet nearly 10 miles. An area of 100 miles radius without a body of water 300 yards in diameter would be very difficult to find in the northern part of the Western Provinces.

It is important at this point to know what an aeroplane or a seaplane can do. This, of course, depends very much upon the type of machine, the power of the engine, and so forth. Furthermore, owing to the greater weight of floats as compared to wheels, the aeroplane can exceed the accomplishments of the seaplane in all the limitations of flying. However, for the purposes of this discussion I shall take the case of about the best British seaplane for general miltiary or naval observation purposes. This is called the Short Seaplane, and is fitted with a 240 h.p. "Renault-merc" motor. It has a speed of 70 miles per hour, and carries 6 hours' fuel. It can climb to an altitude of 12 to 15 thousand feet. This machine can carry in addition to fuel, pilot and observer, and wireless set, about 300 lbs. of extra weight. All modern machines are equipped with wireless telegraph or telephone instruments with a radius of about 100 miles. This would serve as an easy means of communication between the seaplane and its base. Carrying, as it does, fuel for 6 hours at 70 miles per hour, this seaplane can be safely depended upon for 300 miles in a single flight. These accomplishments can be practically equalled by the Curtiss H. S. II Seaplane, fitted with "Liberty" motors such as were used in the Atlantic coast patrols around Halifax last summer.

Aeroplanes and seaplanes are now being provided with a gyroscopic compass. By this means all local attraction is overcome, and the point remains in the same direction throughout the flight. Such an instrument prevents pilots from getting lost and enables them to maintain a true course.

It is necessary to emphasize the very elaborate and efficient organization which is necessary for successful flying operations. Many people entertain the erroneous idea that all that is necessary for flying is for the machine to be run out on the flying ground, for pilot and observer to climb aboard, the mechanic to give the propeller a twist, and the flight begins. The actual flying is a very small part of the problem. It is not proposed that it is feasible to create a separate little organization to conduct the flying operations for each small district, which is to be surveyed. I shall show how it is possible for a single machine even under unfavourable conditions of location to photograph 300 square miles in a day. Thus it is obviously unprofitable to create an organization to conduct merely a few days' operations. As Col. Cull pointed out in his lecture already mentioned, before the Geodetic Society, to place flying on an economic basis in Canada, a very large and permanent organization is required. Permanent depots would be established at suitable intervals and convenient places from coast to coast. In the three middle Western Provinces, for instance, there might be depots at Winnipeg in Manitoba, Regina or Saskatoon in Saskatchewan, and Calgary or Edmonton in Alberta. These depots or bases would be equipped with various types of machines for various purposes. They would also have stores of spare parts and supplementary equipment, shops for extensive repairs and the necessary personnel and staff allotted to each. An organization such as this should be prepared to handle flying operations of every description. They should have machines of specialized types for the various purposes of transportation of passengers, express and mail, of exploration work, of surveying, and of forestry protection.

It is important to point out here that all the latest and greatest developments of the aeroplane have taken place during a time of war. Therefore the development has all been with the sole object of military efficiency in view. To show how rapid the advance has been I may say, that a type of machine a year old was entirely out of date. Frequently, in fact types were out of date before they could be produced in quantity. Military efficiency, which has been the object in view thus far, consists chiefly in high speed, and very rapid climbing power. There is, therefore, plenty of opportunity for experiment and progress in designing machines with a higher degree of efficiency for the various purposes of peace time. Thus, by dispensing with the necessity of rapid climbing, high speed and the carrying of armament, machines may be developed with greater stability, more excess power, producing longer life, and with greater radius of flight, i.e. ability to travel greater distances. I am basing my rough estimates of the possibilities and costs of aeroplane or seaplane work in connection with surveying, upon the accomplishments of a machine designed for military purposes. As I have pointed out, this does not by any means represent the limit of what planes may be developed to do, and any increase in the effective flying range would result in a proportionate reduction in the per acre cost of the work, as well as increasing the distances which could be reached with facility by means of these machines. One great advantage then of having aeronautics in Canada in the hands of a powerful organization is that they would be in a position to experiment and endeavour to perfect types of machines specially adapted to the nature of the work required of them. Another advantage is that the whole cost of equipment and machine would not be a charge against each little job to be performed. That would make the cost prohibitive. Instead, the charge would simply be proportionate to the life of equipment used, together with actual expenses of the expedition, and a proportion of the overhead costs of the general organization. Under this scheme the personnel required for flying would be continuously and permanently employed. After returning from one expedition they would be detailed to another.

All the above considerations point to one conclusion, namely, the necessity for a National Air Service in Canada. We had the foundation of such a service in the organization begun under the direction of Col. Cull in connection with the Department of Naval Service. I am sure that it is with regret that all who are interested in the future of flying in this country have seen this early organization disbanded, instead of being allowed to expand to broader fields and attempt to tackle the problem comprehensively. The other leading countries of the world are preparing to enter actively upon this latest field of scientific progress. The result must be that Canada will fall far behind, and with the leading men in this work attracted to other countries, have to begin over again under a decided handicap. At present there are many trained Canadian airmen returning to this country. With no opportunities along this line open to them, the best of these men will be either attracted to other countries, or else take up other work. Thus in three or four years they will not be available. Furthermore, the British Government has intimated its willingness to turn over its surplus air equipment to the Dominions as a gift or at very low cost. Therefore the conditions for establishing a National Air Service will never again be so favorable as they are at present.

The only alternative to a National Air Service seems to be an organization under private direction, large and powerful enough to deal with the question in a comprehensive manner. There is a serious danger in the application of flying to peace requirements falling into the hands of small private concerns. This is a field in which false economy might frequently prove disastrous. Even if such ventures proved successful the costs would probably be very high. The result might easily be to create a prejudice in the public mind against the whole attempt to apply the present day possibilities of the medium of the air to the various requirements of civilization.

Regarding the question of the cost of surveying by means of the seaplane, it is impossible to give more than a rough estimate. Very much depends on the location and upon the area of the district to be covered. What the overhead charges involved in an organization such as I have outlined, would be, is also an unknown quantity.

In attempting to reach a rough estimate of the cost of the field work in surveying by seaplanes, I shall take two cases. In the first the area will be small, say 1,500 square miles. In the second case, it will be large enough to consume nearly the whole engine life, between overhauls, of several machines, or about 15,000 square miles. That will show the reduction in cost produced by doing a large area at one time. In both cases these areas will be considered as having their centres at least 100 miles north of the most northerly railway points in the west. On this basis districts could be covered up to Reindeer Lake in Manitoba, north of the Churchill River in Saskatchewan, and up to a line from Athabaska Lake to the Peace River Block in Alberta. Districts on the prairies, or within 100 miles of railway facilities could obviously be covered at less expense than the areas to be considered.

Railway transportation is a big item in the cost of this work. The freight rates on flying material are extremely high, owing to its fragile nature, and its great bulk compared to its weight. While a seaplane unrigged and crated for shipment weighs only about two tons, it requires a whole flat car to accommodate it. Rates also differ widely for different localities of the west. On the average at present it would cost about 60 cents per mile to transport an aeroplane and its accessories, fuel, spare parts and equipment. When this class of freight becomes of more frequent occurrence, experience may well prove that these rates may be reasonably reduced. In the cases to be figured upon provision will be made for transportation charges for 500 miles and return, as the distance from the depot to the nearest railway point to the area to be surveyed. This is roughly the distance from Winnipeg to LePas, or from Calgary to the Peace River. Only rarely, therefore, would these charges be exceeded, while in the great majority of cases they would not be equalled.

It is proposed that for surveying purposes, photographs will be taken from an elevation of about 10,000 feet. Seaplanes can easily maintain this height. In France this work was frequently carried out at altitudes ranging up to 20,000 feet. The greater height has the advantage that each photograph covers a larger area, and at the front there was the more important advantage still of freedom from anti-aircraft, or "archie" fire. However, seaplanes at the present stage of their development cannot climb above 15,000 feet. Furthermore, special electrically heated clothing is required for the airmen at the greatest elevations, and there is a much greater likelihood of the interference of cloud masses with the view. Therefore 10,000 feet seems a conservative and practical height to figure upon. The disadvantage of the small area covered by each photograph might well be counteracted by the designing of cameras with a wider angle of vision. The military cameras were designed to produce very minute details. Thus in a photograph at from six to eight thousand feet, it was possible with a magnifying glass to discern men crouching in shell holes. Such refinement of detail as that is not required for surveying purposes. So a camera should be designed to cover a larger field an a smaller scale. The British military camera with the largest field covers, at an altitude of 10,000 feet, an area roughly 1.6 miles by 1.2 miles, on a 4x5 plate. Allowing for one photograph to be overlapped by others by one inch on all sides, the average area covered by each plate would be 1.3 miles by .9 miles. Thus, taking the longer dimension, the seapane would photograph a strip of country 1.3 miles wide. Taking the plane's flight as 150 miles and return, and allowing 25 miles each way for climbing or reaching the required location, the area covered in a single patrol would be 325 square miles, or in round numbers, 300 square miles. This area would represent about 5 hours' flying for one machine. This makes an average day's work for both machine and airman, although in a case of urgency each could probably stand 8 hours in a day.

Basing the estimate upon the British Short Seaplane, equipped with 240 horse power Renault-merc engine, the original costs would be about $3,000 for the plane and $4,000 for the motor, at present high manufacturers' prices. Taking the life of the plane as 1,000 hours with 4 overhauls, the total outlay would be $4,200 for the thousand hours. Similarly for the engine the outlay would be $5,600 for 500 hours. On this basis the cost of the whole seaplane per flying hour is $15.40.

Returning to the first case to be considered that is, the area of 1,500 square miles, three machines would be quite sufficient for the job. The whole expedition would be transported by rail from the depot to the nearest available point. Here the machines would be unpacked and rigged up. Two of them would be flown to a convenient lake or river in the area to be photographed, a distance of 100 to 150 miles. There a temporary camp would be established, from which two machines would do the photographing. The third seaplane could be utilized to bring fuel and provisions to that camp, i.e. act as feeder. The personnel required for the whole expedition would be as follows:—

3 pilots, 2 observers,
2 engineers or mechanics,
2 carpenters or riggers,
2 cooks,

about 10 men most of whom could be hired on the spot.

1 surveyor, or if the district was unexplored,

a surveyor and assistant to locate two points by observations. The cost of the whole party per day, including rations, would be about $125.00. Of this party those who would have to go to the temporary camp would be: 2 pilots and observers, 1 engineer, 1 cook, and the surveyor and his assistant. The three machines could carry them in one trip and still take all the equipment required for a couple of days. The actual photography could be done in 2½ days by two planes or 4 days allowing for lost time. A day would be required to establish the temporary camp and another to get out. Three days should be time enough to unpack and rig the machines and another three days packing them after the work was done. Two days would be lost each way in railway travel. The total time required therefore for the whole expedition would be about 16 days. It would involve a total of 50 hours flying for all the machines.

The costs may be summed up as follows:—

Transportation, freight, 3 planes at 60c per mile per plane for 1,000 miles	$1,800.00
Passengers, 23 men at 8c per mile per man return for 500 miles	920.00
Pay and rations, 16 days at $125.00	2,000.00
Proportion of cost of machines for 50 hrs. flying at $15.40 per hour	770.00
Total for 1,500 square miles	$5,490.00
Total per square mile	$3.66
Total per acre	$ .0057

To this must be added a certain proportion of the overhead expense of the national organization which provided this air service. This should not amount to more than 20% of the field expenses exclusive of transportation. This would all about .03c per acre, making less than 2/3c per acre altogether. There would be a further fixed cost for developing plates and plotting the maps.

A day lost by delays or bad weather over and above those allowed for in the estimate would increase the cost of the whole expedition by $125.00. An additional day of flying beyond those reckoned upon would increase the total cost, if each machine flew 5 hours by $356.00. Thus in neither case would an extra couple of days make an appreciable difference in the cost per acre of the work.

It is interesting to note that of the above cost nearly one half is made up of transportation. It is evident therefore that if a larger area be covered, the per acre cost will be reduced, or if the distance of transportation is less it would have a material effect in reducing the cost of the work.

In the second example the same unfavorable conditions of locality will be assumed, but the area is now ten times as large, namely 15,000 square miles. It would be safe to allot six machines to such a task. Two machines would do the photographing as before, and a third act as feeder to them. The other three would be spares in case of break-down. By a judicious alternation of the machines none of them would require engine overhaul during the course of the work, i.e. none of them need exceed 100 hours of flying. The personnel in this case would be 4 pilots, 3 observers, 3 mechanics, 3 riggers, 1 photo rating, and otherwise the same, making cost of $160 per day for pay and provisions. The photo rating is a man to develop photographs. In covering so large an area, single strips of country might, with advantage, be photographed first about 30 miles apart, and by carrying these photographs the airmen could locate themselves and avoid missing any of the area. For such a large tract it might also be better to have a large type of machine to act as feeder to the others, one which could transport considerably heavier loads, if necessary.

The time lost in travel and in setting up machines would be the same as before, since all machines would not have to be set up to start with. An area of 15,000 square miles would be about 122 miles square, and could be conveniently covered from four temporary camps. For two machines about 7 days would be required to cover the area convenient to each one. In addition there would be a day for photographing guiding strips and a day for moving camp. This makes 9 days at each camp, or 36 days to cover the whole work. Allowing for Sundays, bad weather and delays, this might be increased to 60 days, at the outside. The total time required for the expedition in this case would be 70 days. The flying time in machine hours would amount to:

Photographing from 4 camps, 8 days at each camp, for two machines doing 5 hours each	320 hours
Moving camp, 5 times employing 3 machines about 3 hours each	45 hours
Feeder working for 8 days to each of 4 camps for 3 hours each day and allowing for about 20 days when photography was impossible	156 hours
Total	521 hours

The cost in this example may now be summed up as follows:—

Transportation, freight of 6 machines	$ 3,600
Passengers, 28 men at 8c per mile per man return for 500 miles	1,120
Pay and provisions, 70 days at $160.	11,200
Proportion of cost of machines for 521 hours at $15.40 per hour	8,020
Total for 15,000 square miles	$23,940
Total cost per square mile	$1.60
Total cost per acre	$ .0025

If an overhead charge of .03c per acre be added to this it makes a cost of less than 1/3c per acre. Increases in the expenses of the expedition for days lost would be the same as before and would be still more inappreciable in the total.

There are two difficulties in connection with this work which have probably occurred to many of you. These are weather conditions and breakdowns. With regard to the former, modern machines are immune from danger in quite severe storms. Planes at the front continue flying through thunder storms and squalls without difficulty. Such storms would, of course, interfere with photographing, but as long as clouds are above 10,000 feet they need not interrupt the work. On the subject of breakdowns, under normal conditions with good machines that are well looked after, engine trouble during flight is very rare. In over 400 hours of flying near Halifax last summer there were only two cases of engine trouble, and in both of these the pilot simply landed, repaired the trouble and went on his way. Major McLaurin tells me that he has flown for over 500 hours without having engine trouble. So with proper care ,breakdowns during a flight need be of very rare occurrence.

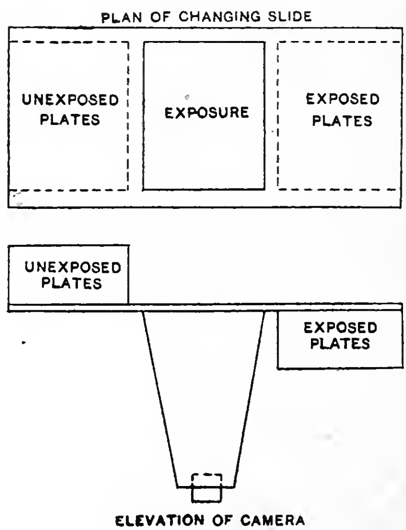
Thus we find costs ranging from 1/3c to 2/3c per acre, depending upon the area to be photographed. In this rough figuring I have tried to over-estimate rather than under-estimate the charges. However, there are necessarily many contingencies I have not allowed for. On the other hand, practical experience would probably effect numerous economies in the expenses outlined. Similarly, the location of the work would have a very marked effect upon the cost of the undertaking and the figures I have given are based upon unfavorable conditions in this respect.

The reason I have given so much space to the consideration of the cost is that this is generally considered the crucial point of the whole question. I have shown that provided there is the proper organization to conduct the flying operations the cost should be very low. But it all depends upon that condition.

AERIAL PHOTOGRAPHY.

I regret to say that upon this feature of the subject I have been unable to obtain much definite information. At the beginning of the war photographs were taken from heights of a few thousand feet, and even then the degree of clearness in the details shown was of low order. However, this branch of the aerial work has been greatly perfected during the war, and I trust that the slides shown of photographs at 20;000 feet will be convincing evidence that photographs taken even from this altitude show sufficient detail for all the requirements of surveying. The advances have been made in the design and construction of aerial cameras have been effected under the veil of secrecy which pertains in all military matters, and the veil has not been lifted in this respect as yet.

DIAGRAM I



A rough diagram of the shape and arrangement of the British camera is shown. The camera has a fixed focus of a fixed diaphragm aperture. Owing to the necessity for very brief exposure, the shutter is of the roller blind variety, i.e. a blind fixed immediately in front of the plate, this blind having a slit in it which passes across the plate. The plates are carried in box containers holding eighteen each. The full container is slipped on the plate changing contrivance at one side of the camera, while an empty container is slipped on the other side to receive the exposed plates. With this device a slide at the top i.e. the back of the camera with the optical axis vertical, receives the plate from the first container holds it in position for exposure, and then deposits the exposed plate in the second container. A simple handle fixed to the slide enables the observer to effect these changes with thickly gloved hands. Observers are supplied with tabulated cards, showing the interval between exposures, at various heights, and speeds, in order to assure that the photographs will overlap an inch. Shortly before the war stopped, the Germans had, I believe, perfected a device for automatically changing the plates at an adjustable time interval. This device is operated by a small propellor attached to the fusilage of the aeroplane. When the aeroplane is over the locality where photographing is to begin, the airman simply starts the device operating, and then stops it when the required area has been covered. The British had also perfected a clockwork mechanism which automatically changed the plates. The required time interval between exposures could be set and the mechanism did the rest.

British cameras have been made in different sizes, i.e. with different focal lengths. The size of the plate in all these cases is 4x5 inches. The following are the focal lengths of the cameras recently employed, together with the area of ground photographed from an altitude of 1,000 feet.

f.— 6 inches, 277x222 yards. f.— 8 inches, 208x166 yards.
f.—10 inches, 166x133 yards. f.—20 inches, 83x 66 yards.

This gives an angle of vision for the longer dimension of the plate, as follows: 45°, 34°, 28°, 14° respectively. The shortest, i.e. the 6 inch focal length is the one most frequently used for general purposes, the longer lengths being employed when a greater refinement of detail is required. However, for the purposes of Dominion Land Surveying the shortest focal length would show all the detail required, since I am sure that an ordinary corner monument not hidden by trees could be picked out in such a photograph.

The camera may either be attached to the side of the fusilage of the aeroplane at the observers right hand, or, as in many cases it may be right in the fusilage and sight through a hole in the floor. The camera may be surrounded with sponge rubber padding in either case to absorb the vibrations of the plane. For taking map-like photograph of the terrain it is necessary to have the optical axis at the moment of exposure, perpendicular. In France this was accomplished by placing two sights convenient to the eye of the pilot. The camera was fixed with its optical axis at right angles to these sights. The pilot then brought the line of these sights to the horizon when an exposure was to be made. The pilot can tell very closely when his machine is on an even keel, and thus prevent lateral inclination. This adjustment of the perpendicular was close enough for all military purposes. However, it is very doubtful whether sufficient accuracy could be obtained by this means for the purposes of surveying. Better results might be obtained by mounting bubbles on the camera in such a manner that the plate would be parallel and the optical axis normal to their plane. Greater accuracy still might be obtained by photographing the position of the bubbles simultaneously with the exposure of the camera. However, there is this great objection to the use of bubbles, that if the aeroplane be describing a curve the bubbles are affected by centrifugal force. In making a turn the airman banks, i.e. tilts his machine sideways. If this is done properly the bubbles would still remain centred although the camera axis would be far from perpendicular. With the machine flying on a straight course, as would usually be the case while photographing, this objection would not be present However, by the application of the gyroscope to the camera, all these difficulties should be overcome. Already a gyroscopic instrument for showing when the aeroplane is level has been used.

It is important to know the altitude of the machine for each photograph. The only satisfactory means of determining altitude so far devised is the aneroid barometer. However, a good barometer may be sufficiently sensitive to record a change of a few feet, and by calibrating the instrument before the flight begins, and keeping a record of barometer readings on the ground during its progress, very close results might be obtained.

In the Royal Air Force the 4x5 negatives are enlarged to prints about 8x10. In a photograph taken from an altitude of 10,000 feet with the camera of 6 inch focal length, this would give a scale on the enlargement of about 277 yards to an inch or 1/10,000 approximately.

I have tried to outline briefly the problems involved in taking photographs from an aeroplane. Owing to the absence of definite information at present, it has been impossible to explain in detail how these problems have been solved. However, the high degree of perfection which has been reached in other lines of photography, is an indication that cameras may be adapted to fulfill all the requirements of actual photography as applied to surveying. It is safe to say that cameras may be designed to produce a true horizontal perspective of the ground surface, entirely free from distortion, and all the other faults to which photographs are frequently subject, and at the same time with a wider angle lens than those at present in use.

THE APPLICATION OF AERIAL PHOTOGRAPHY TO SURVEYING.

During the war these photographs have been employed principally in two ways. First, the bearings and scale of the photograph have been reduced from points in them shown on the regular ordnance maps. The additional data, is then transferred from the enlargement to these maps. By this means maps were produced at frequent intervals, showing all the German trench systems up to a given date.

In the other means of employing the photographs, they were made into what are called "mosaics." The prints are cut, and matched together, and pasted upon a large sheet of paper, producing a map made up of the actual photographs. To obtain these an aeroplane would set out and take a whole series of views at a uniform height, and with an interval between exposures such that the photographs would overlap an inch or so. The terrain in northern France being fairly flat, and the optical axis of the camera practically perpendicular, the various parts of the mosaic would match very closely. The scale could be calculated either from the altitude of the plane or from an ordnance map.

Aerial photographs were sometimes employed in another manner, of interest worth mentioning. If two views were taken from the same height, at a short interval, so that they overlapped considerably, and then the common parts were mounted properly and viewed through a stereoscope, the differences of elevation of points upon the ground were then impressed upon the vision. By this means the depth of trenches for instance could be estimated. Furthermore a still finer definition of detail was thereby produced. Col. Cull states that it was possible by this means to determine from photographs taken at 20,000 feet whether a gun emplacement was built of sandbags or concrete. It should be possible by employing photographs of this sort, with an instrument such as the stereo-comparator to measure the elevation of points on the ground, with a degree of accuracy sufficient for the drawing of contours.

In surveying in Canada aerial photographs would usually be employed as a means of collecting data for making regular maps. For this purpose it is necessary to know the elevation of the instrument at the time of exposure, the inclination of the optical axis to the ground plane, and the location of the photograph. I have already explained how the first two necessities may be satisfied. There are various means of determining the location of the photograph.

It is assumed that the position of the principal point, i.e. the point at which the optical axis meets the plane of the plate, and to which it must be normal, has previously been determined for the camera. This point may be marked by cross hairs in the camera, or by the preferable method of intersecting lines joining points shown on the edge of each photograph, as is the case with the Canadian surveying cameras.

It is of interest to note the relation between the elevation of a point above the ground plane and its position on the photograph with regard to the principal point. This is illustrated in diagram II. A plane is passed through the station S. the principal point P. and the perspective d of a point on the photograph. The trace of the picture plane, i.e. the photograph, on this plane is in the line d P. S.A. is the trace of the ground plane on a scale of 1/20,000. A. is the point in space at an elevation h. above the ground plane, a. is its projection on the ground plane. The perspective of this projection a. is in k. The distance intercepted between the lines S d. and S k., on the ground plane is r., and on the picture plane l. S P. is the principal line cutting the ground plane in s. M. is the angle d S P.

$$r = h \tan m$$

$$l = r \frac{SP}{Ss}$$

$$\therefore l = \frac{SP}{Ss} h \tan m$$

DIAGRAM II

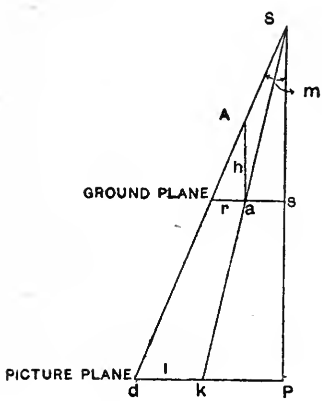
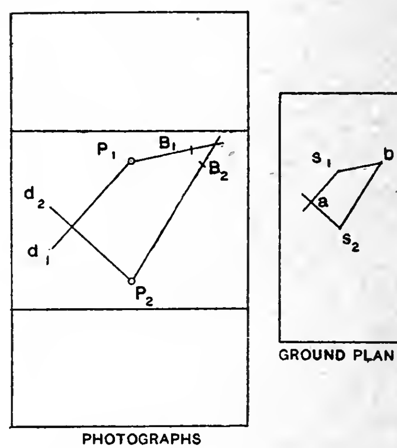


DIAGRAM III



This equation gives the displacement l of the perspective of the point at the edge of the photograph as .05 ins. per hundred feet, elevation of the point, above the ground plane. This is taking the case of an 8x10 enlargement from the camera of 6 inch focal length exposed at an altitude of 10,000 feet. This displacement would decrease proportionately to the tan. of the angle m as the principle point is approached. It is therefore evident that in fairly level districts and employing points away from the margin of the photograph, any displacement of these points due to a difference in elevation is negligible.

To return to the question of determining the position of an aerial photograph, the above explanation suggests the simplest and best method of determining position. Given two points in the view i.e. given the projection of those points on the ground plane and their elevation, the position of the principal point, and therefore of the whole photograph is determined. In level country, along river courses which have not much fall, along large lakes and coast lines, pairs of points may be carried from one photograph to another and thus the position of a whole series be determined. The objection to this method would be that in steadily rising country the displacement of succeeding photographs from their true position would be cumulative. Even so, it would be negligible in most sections of the middle western provinces over distances up to 100 miles.

Two other methods of determining the position of the principal point for each view have been suggested. The first is that of taking a reading with the theodolite on the aeroplane at the instant of each exposure. The time of the exposure could of course be given by wireless. Readings would be taken of both elevation and azimuth, or else readings of azimuth only from two stations sufficiently far apart for their lines of intersection to make nearly a right angle. However, it is doubtful whether a plane 10,000 feet up would be visible even through a telescope and in clear atmosphere at more than 20 miles. And if it were a variation of a few seconds in the readings would have a disastrous effect upon the accuracy of the location of the plane at such great distances.

The second method is by simply employing wireless instruments. It is, I believe, now possible to determine the direction of the station sending a wireless message. However, it is extremely doubtful whether this apparatus can be so perfected as to give the position of an aeroplane 100 miles or more distant, with sufficient accuracy for this purpose.

There is one other point in connection with aerial photographs, to which I wish to call your attention. Suppose that the position of two which overlap considerably is known, i.e. that the point at which the principal line pierces the ground plane, and the orientation of the photographs are determined. Then irrespective of differences of elevation the projections on the ground plane of all points appearing in both views may be determined by the intersections of lines joining their perspectives to the principal point, as illustrated in diagram III. By the construction previously explained the elevations of these points could then be calculated with a degree of accuracy, depending upon the distance of their perspectives from the principal point.

This suggests the further method of locating the position of each of a series of photographs by taking them overlapping sufficiently for a pair of points to appear in three successive views. Two known points appear in photographs one and two. The principal points of these may therefore be located and the positions of another pair of points appearing in both, be determined by intersections. This pair of points would appear in photograph three so that it might be located. Similarly the process might be carried on to locate all of the series and by this method any displacement due to difference of elevation of points in the terrain would be corrected. However, the number of photographs required to cover a large area could be very considerable, thereby decreasing the speed of the field work and increasing the cost. Furthermore, the office work of plotting would be rather complicated. However, such a method might be very useful in making plans of cities or small areas of rough country. The elevations of points in the terrain could then be calculated probably within 25 feet.

Still better results, though, in a case like this, should be obtained, I am sure, with the stereo-comparator. This is an instrument for measuring the co-ordinates of points shown in two stereoscopic views. Its principles and use are very well described in an article by Otto Lemberger on page 602 of the American Engineering News for March 27th, 1913. Two photographs are taken from the ends of a known base in such a manner that the plates are vertical and both in the same vertical plane. The same principles would apply to aerial photographs. With both plates horizontal when exposed and at the same elevation they would be in the same plane. The distance between them would be calculated from time interval and speed.

I wish to point out the various types of surveying to which photographs from aeroplanes could be most suitably applied.

First,—town plans. I have just explained how town plans could be obtained by this method with a high degree of accuracy, and some estimation made of the heights of buildings, bridges and so forth, as well as elevations of points on the ground.

Second,—to bring old maps up to date in settled districts, as, for instance, Militia Maps of Ontario. The photographs could easily be placed in proper position on these maps and additional topographical features such as new buildings, roads, bridges, etc., conveniently added.

Third,—to obtain the topography of subdivided lands in the west. I am sure that even in wooded country sufficient lines or monuments could be picked up in the photograph to accurately determine its position. The limits of forest growth, open spaces, bodies of water, swamps, etc., could then be accurately plotted. Furthermore it is probable that with experience some indication of the nature of the soil could be obtained. This method seems to be particularly adapted to work such as is being carried on now by the Soldiers' Settlement Board, in trying to locate lands suitable for immediate settlement.

Fourth,—to obtain topographical maps of unexplored regions of flat country. The method would be sufficiently accurate for this purpose in all parts of the middle west.

Fifth,—for making traverses of large lakes with islands, or of systems of lakes. As in this case all points would be practically in the same plane aerial photographs would give very accurate results. The same conditions would apply along the sea coasts. In connection with bodies of water, aerial photographs have this advantage that if the water is at all clear objects may be seen in it at surprising depths. This fact was employed in connection with the submarine campaign, the underwater craft, even when submerged, being visible to an eye in the air. Therefore in connection with lakes and sea coasts some indication of the configuration of the bottom might be obtained.

In considering this subject of utilizing aerial photographs for surveying purposes, I have discussed it in connection with the aeroplane alone. The possibilities of the airship, i.e. the lighter than air craft, have not been considered. While great progress has been made in recent years in the construction of these craft, owing to their unsuitability for the conditions of land warfare, they have not come to the fore as much as the aeroplane. What notoriety the German Zeppelins did obtain was of rather an unfavorable nature. However, there may be great possibilities in adapting airships to the requirements of civilization in peace time. These possibilities are being actively dealt with in Great Britain, I believe. The largest British airships of the rigid type, i.e. similar to the Zeppelins, has a weight of 60 tons. It can carry sufficient fuel for three trips across the Atlantic at a speed of 70 miles per hour, this with a load of 20 tons of passengers and freight.

The smaller semi-rigid type, about 150 feet long has a speed of about 50 miles per hour, and can carry only a few passengers. It would be an airship of this type which would be employed in taking aerial photographs for surveying purposes.

The advantages of this airship as compared to the aeroplane may be briefly noted. It can carry fuel to travel much greater distances. Therefore the radius of operation could be increased beyond 200 miles. Owing to the fact that its lifting power is independent of its speed, the airship can remain practically stationary in the air. For this reason it also requires only a very limited space in which to land.

On the other hand the airship suffers from some disadvantages as compared to the aeroplane. It is a great deal more costly, although it has also a considerably longer life. But it is much more likely to be the prey of unfavorable weather conditions. It can only be operated successfully in settled weather, and in the absence of strong winds. A sudden squall of wind during landing or ascent operations is very likely to prove disastrous.

This, gentlemen, concludes my discussion of this interesting subject. The development of flying is a field full of possibilities for the future of this and all countries. If I have convinced you that aerial photography can, with advantage, be used for surveying purposes, I shall consider myself amply rewarded.

The slides made by the Geodetic Survey from photographs belonging to Col. Cull, and kindly loaned by Mr. Ogilvie, will now be shown.

Mr. Akins: We have listened with great pleasure, to Mr. Clarke's treatment of this interesting subject, to which he has evidently given a great deal of time and attention. The matter is now open to discussion.

MR. J. J. MCARTHUR: We are indebted to Mr. Clarke for the trouble that he has taken in preparing this paper. It is a subject which appeals strongly to those of us who have been engaged in this kind of work; we have often wished that we had an aeroplane or a balloon or something else of that nature to carry us up to the necessary height.

Colonel Cull is the only man with whom I have had any discussion of this matter, considering it from the standpoint of control. He claimed that it would be possible to maintain a true course and also to maintain a constant elevation. Well, if that can be done the problem is pretty well solved, so far as the use of the aeroplane in connection with topographical surveying is concerned. The development of the topography from those photographs can be readily accomplished, I should think; at least, any problem that might arise in that connection has already been handled in the development from photographs taken on a vertical plane.

If it were intended to make an accurate survey of a given area, one that would be worth while, it would be necessary to have the ground control. I think it would be utterly impossible to make a survey otherwise. In order for the aviator to get the direction of his course, to determine his altitude at the exact moment when the photograph is taken, and so on, it would need complete co-operation—in fact, I should think it would be practically impossible unless, as he flies along, he gets his control from the ground. Of course, in the case of getting a continuous photographic reproduction of a new country such as the Hudson Bay district, where there are rivers, bends of rivers, and so on, you might make a very fair map with the control at different points along the route. But where accuracy of detail is required in the survey, I should think that the control would have to be taken from the ground.

I do think, however, that the experiment is quite worth while and should be made. Under ordinary circumstances, of course, the expense of making this experiment, as has been explained by Mr. Clarke, would be almost prohibitive. But here in Canada we have several flying centres, and if a good machine could be had and the services of a good man obtained to handle it, a fair experiment might be made, in co-operation with some surveyors on the ground, by making a survey over a country which has already been surveyed. Of course, it would be very foolish to incur an expense of $30,000 in the making of an experiment of this kind away off in the wilds. But in view of the fact that these flying centres are already established in Canada, an experiment might be made which would cost very little, which would be well worth while and which, I am sure, would develop a great many ideas along this line.

DR. DEVILLE: I have always been very much interested in topographical surveys, and the paper which has just been read by Mr. Clarke has certainly been well worth listening to. Mr. Clarke has put a great deal of work into the preparation of this paper and has evidently studied his subject thoroughly.

It is rather difficult to deal with this subject just at present, because we do not yet know enough of the details of the work which has been done at the front. What may appear to us to be serious difficulties may have been solved in the practical work in the air, so that until we know a little more, until we know the details of the work and of the machines that have been employed, and so on, we can only speculate on what can be accomplished in this line.

As to the data which must be ascertained in connection with aerial photography, there are two points to be remembered. In the first place, you must get your altitude; the altitude gives you the scale of your photograph. I hardly think that the ordinary altitude taken by an aeroplane would be accurate enough for ordinary surveying. But you can get your altitude from a traverse made on the ground: if you have two points of a travèrse on a photograph you know the length of your line and you can get your altitude from that—the scale of your photograph.

The other point of information required is the inclination of the plane. I do not know what is the best way of getting at that. That used to be the great difficulty in the earlier days. Photographs have been taken from the air by means of kites and balloons, but these proved to be too unsteady for getting the inclination. However, the modern aeroplane is comparatively steady, and possibly this difficulty can now be overcome—the matter of getting your inclination is one of the problems which may have been solved, for all we know. No doubt, it can be done as indicated by Mr. Clarke, by the use of a photographic bubble or a gyroscope, or something of that kind.

There is just one other point that I would like to mention, and that is, the size of the plates, 4x5. Why should the plates not be square? I can see no reason why they should be shorter on one side than on the other—but that is a small detail, of course, that can be adjusted. On the whole, I would say that the experiment is one which is well worth making.

Mr. Clarke: I do not know any reason why the plates should not be square. I got this information from one of the tabulated cards that I mentioned; a man who had been an obsèrver in France showed me this card. I noticed that the size was there described as 4x5; possibly it was one of the plates that had been in frequent use in England before the war. I should think it would be much better to have it square, as the lens would show just as much in one direction as the other.

With regard to Mr. McArthur's remarks as to experimentation, I did not mean in any way to suggest that we should immediately go out and try to survey an area of 15,000 square miles by means of the aeroplane. I have simply tried to make it appear sufficiently practical to justify the making of an experiment of some kind. That is the whole thing—an experiment is needed. I tried to emphasize in my paper the fact that if we had a National air service, they would be the people who could experiment; they would have all the conveniences and opportunities for carrying out the work. Until we have a National air service it would seem to be very difficult to make any progress in this matter. However, I certainly do think that an experiment is what is needed, and I feel convinced that an experiment would show that the problems involved could be practically solved.

MR. N. J. OGILVIE: Mr. Chairman, I listened with a great deal of pleasure to Mr. Clarke's paper this evening. I have heard Mr. McArthur and Dr. Deville express their views on the subject, and I hardly feel that I am in a position to add very much to what they have said. I do think, however, that the difficulties involved can be brought to a practical solution and that in the near future practically the whole of Canada will be mapped by aerial photography. Of course, as Mr. McArthur suggested, we would have to have control from the ground.

I should like to move a very hearty vote of thanks to Mr. Clarke for the very interesting paper that he has given us this evening.

MR. DODGE: I have much pleasure in seconding that motion.

MR. AKINS: I have much pleasure in conveying to you, Mr. Clarke, the hearty thanks of this meeting for your very interesting paper.

The meeting adjourned until 10 a.m. Thursday, January 30th.

THURSDAY, JANUARY 30TH—MORNING SESSION.

The meetings were resumed at 10 a.m., Mr. Akins in the Chair.

THE CHAIRMAN: The first item this morning is a paper entitled "A Soil Survey" by W. A. Johnston, M.A., B.Ss., soil expert of the Geological Survey.

A SOIL SURVEY.

W. A. Johnston.

In view of the interest which attaches at the present time to soil surveys in Canada, it may not be amiss to discuss briefly the question of classification of soils and some of the field methods of soil surveying.

NATURE AND ORIGIN OF THE SOIL.

First, what is the nature and origin of the soil? Almost everywhere the land surface of the earth is covered by a thin mantle of unconsolidated material overlying the bedrock. This material may be largely derived from the disintegration of the underlying rock in place; or it may be largely foreign to the locality and composed of materials which have been transported by the action of glaciers, or by other means, and, therefore, quite different in character from the underlying rock. It may vary in thickness from a few inches to a hundred feet or more. All of this material cannot be regarded as soil, for, in order to become a true soil, it must be acted upon by life in some form. The soil consists of the uppermost stratum of this unconsolidated material, which has been rendered available for the growth of plant life by processes of weathering, by the gradual accumulation in it of animal and vegetable matter, and by the effect produced upon it by organic agencies. The term soil may be considered as including the surface soil, or soil proper, and the sub-soil. The surface soil consists of the uppermost part, a few inches in thickness, which, in most places and especially in humid regions, is distinguished from the sub-soil by a darker colour. The sub-soil contains less organic matter and has been acted upon by organic agencies to a less extent than the surface soil. Though the soil differs somewhat from the material upon which it is developed or from which it is formed, its mineral constituents, except in the case of organic or peaty soils, usually exceed 90 per cent of the whole. These constituents, therefore, determine to a considerable degree the physical, chemical, and mineralogical character of the soil.

In Canada a very large part of the soil is formed from transported or drift material and comparatively little has been formed from the breaking down of rocks in place. This is due to the fact that, during the latest geological period previous to the present, nearly the whole of Canada was glaciated. Great ice sheets invaded the country and transported large quantities of decomposed and ground-up rock and boulders; this transported material forms the present unconsolidated mantle covering the bedrock. It was deposited in various ways: directly from the ice-sheet, as outwash from the ice; as sediments in glacial lakes or arms of the sea; and as flood-plain deposits of streams. Much of the material was derived from rocks of widely different character, and differences in the character of the rocks have caused wide variations in the character of the soil-material. As a result of the action of the ice-sheets there are also in Canada large areas where the solid rock is exposed at the surface with little or no soil covering.

Various agencies and processes, such as weathering, leaching, frost action, etc., are concerned in the development of the soils from the soil-material. It is well recognized that these have a marked influence in producing variations in the character of the soil, but they appear to be of less importance in determining variation than the physical and mineralogical character of the material from which the soil is derived.

CLASSIFICATION OF SOILS.

It is common knowledge that soils differ in character and in productive value. Because of the numerous kinds of rocks from which the soils are derived and the numerous processes and agencies by which they are formed, they of necessity possess widely differing properties. In classification, therefore, some scheme must be adopted by which their various and complex relations may be shown as far as practicable. A complete or perfect classification would be one under which each type of soil would have distinctive characteristics; these characteristics would be known and described, and would have some definite relation to the causes of productiveness or nonfertility of the soil. Such a classification, however, is not possible because of the lack of sharp lines of division between soils, and because of our imperfect knowledge of the subject. But the need of arranging the soils under some system of classification which will show their important characteristics and relations has long been recognized. Several different bases of classification have been used by investigators who have viewed the problem from different standpoints. The principal bases or systems may be grouped under the following heads: (1) physical properties; (2) chemical properties; (3) nature of vegetation; (4) origin and process of formation; and (5) a combination of two or more of these.

(1) *Physical properties of the soil, including texture, structure, and colour.* By texture is meant the relative proportion of the different sizes of particles comprising the soil. According to texture, soils are divided into a number of classes, those most commonly recognized being sand, sandy loam, loam, clay loam, and clay; and finer divisions may be made depending on the amount of detail desired. The precise definition of each of these classes is determined by mechanical analyses and is purely arbitrary; that is, the relative proportions of different sized particles which comprise a sandy loam soil, for example, are arbitrarily fixed. The definition of the soil classes, as determined by the United States Bureau of Soils, is the one most commonly adopted by soil investigators in North America. That the differences in texture of the soil have a marked influence upon the growth of plants is well recognized. Hence the texture of the soil is an important characteristic which must be taken into account in any scheme of classification. Structure, or the mode of arrangement of the particles, is an important property of the soil. Colour is also a significant physical property of the soil. It is well recognized that a black colour usually indicates a high organic matter content and is almost synonymous with productiveness. Other colours may indicate different conditions. All these factors should be taken into account in a proper classification and description of soils, but they form a basis of classification of the soil material rather than a mode of classifying the soils themselves; for one soil, which may be identical with another soil in texture, for example, may be of entirely different character because of difference in surface relief or because of a difference in mode of origin.

(2) *Chemical properties.* It is well recognized that differences in chemical composition have a marked influence upon fertility, but no method of soil analysis has been devised by which the fertility of the soil can be determined *a priori.* Chemical analysis may be used in the laboratory as a method of studying differences in soils, but a practical classification must be based upon differences which are obvious in a field examination. Certain chemical differences, one of the most important of which is the calcareous or non-calcareous character of the soil, may be rourghly determined in the field, but many other differences cannot be determined. A classification based on variations in chemical character alone, fails to take account of many other factors which have an even greater influence on the growth of plants than the chemical composition.

(3) *Nature of vegetation.* It is well known that a change in native vegetation is usually indicative of a change in soils, and that in some cases the character of the vegetation indicates the agricultural value of the soil. But there are some striking exceptions. Jack pine, for example, favours a light porous soil but is sometimes found growing upon heavy clay. Again, it has been frequently observed that where one kind of forest growth is destroyed by forest fires or by some other means, trees of a different genus replace the old growth, although the soil has not appreciably changed. Vegetation, therefore, may be used as an aid in classification and to some extent to indicate agricultural values, but the basis of classification must be founded on differences in the soils themselves.

(4) *Origin and process of formation (geological).* The geological basis of classification has probably been used more extensively than any other and has formed a part at least of the system adopted by nearly all investigators. Considered on this basis the material from which the soil is derived is of prime importance, and the soils are classified according to the origin and process of formation of the soil material. It is often held that a geological map is a fairly good soil-map. This, however, is true only to a limited extent, for most geological maps show only the bedrock formations and the surface deposits may be quite different from the underlying rock; and even in the case of geological maps showing the different surface formations the geological terms used may not properly describe the soil, for example, the geological term boulder clay does not accurately describe the soil and an area mapped as boulder clay may include several types of soil of different texture.

This defect in the purely geological classification, together with the fact that there are many other factors besides the geological which determine the variations in soils, has led several investigators to attempt to combine two or more of these bases of classification.

COMBINATION SCHEMES OF CLASSIFICATION.

One of the most comprehensive schemes of classification is that adopted by the United States Bureau of Soils. Under this system the country is divided into a number of soil provinces, roughly corresponding to physiographic provinces, in each of which the soils are dominantly of a similar mode of origin. The soils in each province are classified into series, which consist of soils nearly similar in all characteristics except texture, and each series is given a local name. The series are divided into types according to texture or the relative proportion of coarse and fine particles. Under this classification the primary grouping is geological, that is, according to the origin and process of formation of the soil material. The subdivision of the soils into series is based on several factors such as colour, structure, relief and drainage, and origin of the soil material, and different factors are used in different soil provinces. One result of the grouping into series and types on the basis of several different characteristics has resulted in a multiplicity of soil types, over 700 being already recognized by the Bureau of Soils, and this has caused considerable difficulty in correlation. The great number of soil types seems entirely out of proportion to the small number of staple crops and it seems doubtful whether such refinement is necessary on the assumption that the differences in the soils may indicate possible causes of variations in soil fertility.

Another scheme of classification is that proposed by Dr. G. N. Coffey, who for a number of years was a leading scientist of the United States Bureau of Soils. Under his classification the primary grouping is based upon the characteristics of the soils themselves rather than upon the origin and mode of formation of the material from which the soils are formed. That is, he holds that differences in soils are due in a greater degree to variations in the processes of derivation of the soils than to differences in the character of the material from which the soils have been formed. On this basis he makes a major division of the soils into several groups such as arid soils, dark-coloured prairie soils, light-coloured timber soils, etc. It may be objected to this scheme of classification, however, that it involves correlation of soils over wide areas and does not take into account the fact that soils may at one time have been timbered soils and at another time prairie soils or vice versa, and further, it does not seem to be generally agreed among soil investigators that the processes of derivation, such as weathering for example, are more important in producing variations in the character of the soils than the differences in the soil material.

Still another scheme of classification, which is also a combination, is that used by C. G. Hopkins of the University of Illinois. Under this scheme the major divisions of the soils are partly geological, that is according to the origin of the soil material, and partly geographical. According to geographical relations, large groupings are made, such as upland prairie soils, upland timbered soils, terrace soils, and swamp and bottom land soils. Secondarily, the soils are classified according to variations in colour, texture, and structure. Instead of giving local names to the various soil types serial numbers are used, which serve for reference and for correlation purposes.

PRACTICAL CLASSIFICATION.

A practical or approximately satisfactory classification would be one based on the known important factors which constitute soil differences. It seems to be generally recognized by soil investigators that one of the most important factors is the origin and process of formation of the soil-material, and that this should form the basis of a primary classification of the soils; thus soils may be grouped as shown in the following table:

PRIMARY CLASSIFICATION OF SOILS.

Residual or bedrock soils	Swamp soils. Soils from different kinds of rocks, as granite soils, limestone soils, etc.
Transported or drift soils	Aeolian soils. Talus soils. Alluvial soils. Beach soils. Lacustrine soils. Marine soils. Glacial soils, including glacial till, morainic and fluvioglacial soils.

Secondarily, each of these groupings of soils may be subdivided into soil types according to the physical character of the soil. One of the most important of these physical characteristics is the texture or relative proportion of coarse and fine particles comprising the soil. Other factors may be used depending upon their importance and the amount of detail desired. In this secondary classification according to the physical properties of the soil, however, if several factors are used, as for example, colour, texture, structure, chemical characters, etc., a multiplicity of soil types is bound to result because of the numerous combinations possible. Such a refinement may or may not be justified according to the value of the information which it gives. A classification, to be satisfactory, must be adaptable, that is, suitable for mapping purposes on a large or small scale map. For mapping of large areas on a small scale, under this system, most of the major divisions of the soils can be shown or certain divisions can be grouped together, and for large scale mapping the number of soil types grouped under the larger subdivisions will vary according to the amount of detail considered necessary and according to the scale of the map.

FIELD METHODS OF SOIL SURVEYING.

Soil surveying consists of classifying, mapping, and describing the field characteristics of the soils. Soil mapping consists of outlining upon a base map the areal distribution of the different soil types. In order to do this it is, of course, necessary to classify the soils. A general knowledge of the character of the soils of an area may often be obtained by an examination of topographical and geological maps of the area. Thus, if the area falls within a former lake basin or within a section of country in which glacial deposits occupy the greater part of the surface, the general relations or major divisions of the soils are at once approximately known. If the general relations of the soils are known either from a general examination of the region or from other sources of information, the identification of different soil types met with in the area is less difficult, for the larger groupings form a basis for subdivision into soil types according to physical character. A detailed soil map is usually published on a scale of 1 inch to the mile. On this scale it is possible to show all of the principal soil types in most areas. Maps of smaller scale may be used depending on the complexity of soils in the area, or for general reconnaissance work in which several types of soil may be grouped. A topographical or contoured map is especially valuable as a base map for soil mapping as it serves to show the surface relief, an important factor which cannot always be taken into account in the classification. In mapping, soil boundaries are not usually traversed, but are sketched in from fixed points determined by traversing land lines, roads, etc., the number of fixed points depending upon the scale of the map and accuracy desired or deemed necessary. If a base map is not available it is necessary to construct one, which may be done independently of the soil survey or may be carried on at the same time.

The identification of the soil units or types, which are subdivisions of the larger groupings, is based chiefly upon the texture of the soil material, but other factors may be taken into account. In order to determine in the field the texture of the soil material or the soil class to which it is to be referred, it is necessary to be able to distinguish the more important classes, such as coarse sand, fine sand, sandy loam, loam, and clay. In some cases it is impossible to make these distinctions except by a mechanical analysis, and boundaries must necessarily be approximate. As an aid to the field determination of the soil class a set of millimetre sieves graduated from 2 millimetres down to 1/10 millimetre may be used, by means of which an approximate estimate may be made of the relative proportions of coarse and fine material comprising the soil. Soil samples for field and laboratory examination are usually collected with a common wood auger from which the cutting side flanges and bit have been removed. This should be provided with extra couplings so that it may be extended to any desired length. In the collecting of soil samples for purposes of mechanical analysis or for other determinations, it is essential that the soil sample should be typical of the soil type from which it is taken. A sample should be taken of the surface soil down to the depth of change of colour, or if this is not apparent down to the depth of cultivation, and of the sub-soil usually to a depth of 3 feet; the samples of surface soil and sub-soil being kept separate.

A soil survey should also include, as a supplement to the map, an accurate description of the field characteristics of the soils, such as colour and amount of organic matter, natural vegetation, surface relief and drainage, structure, and marked chemical or mineralogical features; for it is mainly by the determination of the field characteristics that the fertility or lack of fertility of the soil and its adaptation to different crops is indicated, which is the chief end and object of a soil survey.

Mr. Johnston exhibited and explained a standard set of sieves for determining the relative proportions of coarse and fine material in the soil and defining the different classes. He said:

These are the standard sieves which are used by soil investigators, and other investigators in the United States, to determine the relative proportions of coarse and fine material in the soil and to determine the different classes. The two top sieves have spaces of two millimetres while the lower sieves are made of silk bolting cloth the lowest and finest being a sieve having spaces of one-tenth of a millimetre. The sieves will separate different grades of sand, silt and clay. It is important to remember that not only are the different proportions which go to make up different soils arbitrarily fixed, but two of the different kinds are fixed according to the definition of the United States Bureau of Soils. They are divided as between clay, silt and sand. It is necessary to do that because there is no definition of what is clay and what is silt. This set of sieves might be used in the field to give you an approximate estimate of the relative proportions of the different grades and particles composing the soil. They will not separate sand from silt and clay, which must be separated by erosion in water.

The paper was illustrated by a map, in explanation of which Mr. Johnston said:

This map illustrates the classification of some of the soils. The map shows a part of the Winnipegosis area and the scale is three miles to the inch. The purple areas represent swamp, muck, and peat. Under the legend at the side is the geological formation showing the age and origin of the soil material. At the right hand corner are the soils themselves; this (indicating) shows the major classification and this (indicating) shows the secondary classification. Upon ordinary soil maps it would not be necessary to show this second column. You might show in the major division swampy soils consisting of muck and peat and they are separated or not according to the scope of the map and the importance of the area. Then, you have the aeolian, or wind blown soils, ordinarily called dune sand. Then we come to these soils (indicating) which are somewhat different. First there are the beach sand soils made up of old beaches which everybody who has travelled in Manitoba has probably seen. This illustrates how such classifications might be taken into account topographically. As everybody knows, an old beach is a long, narrow strip of land. When we see a beach sand soil it shows, to some extent, the surface relief of the soil and its general character. The next is this yellow colour which shows the lake sand, or sandy loam, mostly fine sand and sandy loam. The term "lake sand" implies that it is formed from the bottom of an old lake and is likely to have a surface that is fairly level and uniform. Then we come to the glacial soils, that is, glacial boulder clay which is shown in this darker green colour. That is divided into two divisions—lake clay and stony loam. The stony loam is so stony that it is practically worthless as agricultural land except for grazing. In the descriptions of the different soils there is also indicated the general character of the soils themselves, distinguishing between fine sand, sandy loam, clay loam, and clay. The high areas are separated from the swamps, each being shown alone and marked by their respective symbols. An important factor also is the vegetation, which cannot very well be taken into account in the classification of the soils themselves. You have here two letters or symbols which indicate different kinds of trees. Letters are distributed over the map to indicate that a certain kind of forest growth occurs where these letters are placed. Mr. Plunkett was right regarding a large part of that region; it is decidedly wet. There are very numerous swamps but there are also considerable areas between these swamps of clay land which, with drainage, will eventually make agricultural land. The problem of drainage comes in and that is the major problem in that country. It is, of course, necessary to know where the swamps are, and to have some idea of their extent and distribution throughout the area, before any definite scheme of drainage can be adopted. A contour map would be much more valuable still but the attempt to make a contour map of that district at the present time would be very expensive. One of the advantages of such a map would be that it would show not only the available agricultural land but the distribution of the swampy areas which will require drainage before anything practical can be done.

Mr. Akins: We have all listened to Mr. Johnston's paper with a great deal of interest and it is a very profitable one indeed taken in connection with the paper by Mr. Brenot yesterday afternoon on the Classification of Land. The meeting is open for discussion.

Mr. Blanchet: How would you classify the coarse sand north of the Saskatchewan?

Mr. Johnston: I am not personally acquainted with any part of the country north of the Saskatchewan. All I know is what I have read of the accounts of explorers.

Mr. Blanchet: Take the area between the Saskatchewan and Churchill.

Mr. Johnston: That has been described by Mr. McInnes and several others who, if I remember rightly, treat it as drift. The sandy soils of the region I should judge would be glacial drifts and there would also be wind blown soil. It is comparatively easy to determine wind blown soils because, if they are cleared, they begin to blow at once. It is not so easy however if the land is timbered. They can generally be determined from an examination of the surface soil. Then you would have to classify them secondarily according to texture.

Mr. Wright: Do you place any reliance upon the so-called mechanical, or water analysis of soil? It frequently happens that an engineer has not an elaborate set of sieves for determining the properties of the soil. The water analysis consists in taking a glass jar of water, placing a quantity of soil in it, shaking it up, and noticing the strata, or the manner in which the material settles.

Mr. Johnston: I have never used that system and I do not know if it is used extensively by the United States Bureau of Soils or by any of the State surveys in the United States. The dry method is the one that I am familiar with and it has been used commonly.

Mr. Shaver: What effect has fire on soil? Suppose we have a swamp and fire runs over it in the fall or summer and burns away a part of the surface, what effect would that have on the crop or productive power of the soil?

Mr. Johnston: There are several considerations in reference to that. You must consider whether it had originally been swamp soil or a locality where the surface deposits consist of what is commonly called muck or peat. It is important to remember that the value of almost all swamp soils depends on the depth of the material. If it is not over three feet after it is drained it is possible to get rid of it; or if you burned it off without destroying it entirely, you may get some valuable soil out of it. That has been the result in many cases in the West noticed by different travellers and surveyors. It has been found that after a forest fire has gone over a swamp deposit there is a luxuriant growth of vegetation. The main reason is that it has destroyed a large part of the purely organic soil which is lacking in mineral soil as well as sand. Fire tends to remove the organic matter from the soil.

Mr. Fawcett: Is it possible to value soil by mechanical analysis?

Mr. Johnston: The value of mechanical analysis is partly to give an accurate description of the soil and partly to furnish information which has some bearing on the question of fertility. It does not tell you altogether but it does tell you just what every good farmer knows, that the finer grained soils are more valuable, if other conditions are equal, than the coarser grained soils. Of course, most farmers will say that the best soil is a clay loam or a fine sandy loam. On the other hand, that depends on conditions. In the Red River Valley the black alluvial soil is a clay soil and is one of the most fertile in the world, the reason for that chiefly being that it contains a very large quantity of organic matter in the form of humus and this humus has the effect of making that clay soil easily worked. If clay soil is easily worked, and can be put into good tilth, it is a very good soil. On the other hand, clay soils that cannot be easily worked are not nearly so valuable. The question is relative. I think mechanical analysis does give you some definite information as to the character of the soil.

Mr. Dennis: I understood Mr. Johnston to say that in the mechanical analysis he divided the descriptions of soils into clay, silt, and sand. I was under the impression that clay, silt and sand were really definitions resulting from chemical analysis. Is that correct?

Mr. Johnston: It depends upon what your definition of clay is. According to the United States Bureau of Soils the definition of clay is arbitrarily fixed as being any material consisting of particles less in size than 1/200ths of a millimetre. Geologists might perhaps use the term "clay" more generally than chemists.

Mr. Wright: Is the humus content of the soils the governing factor in ascertaining its value?

Mr. Johnston: A great many of these questions might better be answered by a scientific agriculturist than by a geologist, but there is no doubt that in a great many cases the humus content—that is the true humus—not the organic matter, which is quite a different thing—is one of the chief elements of value in agricultural soils. You have all noticed the extraordinary depth of surface soil in some places. Sometimes you will have 18 inches of black clay stained with humus and that, most undoubtedly, is one of the chief causes of fertility. Generally speaking, a black colour of soil is recognized as the measure of its fertility and the black colour is chiefly due to its humus content.

Mr. Currie: We always understood that clay was alumina silicate and it has been associated in our mind with the making of bricks.

Mr. Johnston: I think that what you are referring to would be known as kaolin. There have been other terms used, such as mud. It is very sticky. Clay is also described sometimes as being a material that is highly plastic or which may be changed into a colloidal material. That is the description which is used by brick-makers but it is quite different from the definition used by soil investigators. That may be peculiar, I think, to the structure of the material which cause a tendency to bake and dry, but ordinarily by soil investigators clay is determined by materials containing particles of less than a certain size only.

Mr. Akins: Dr. Deville might say a few words.

Dr. Deville: This is a very valuable paper and especially useful to people who have to deal with land. I believe that we should have a good deal more of this kind of investigation. The discussion on Mr. Brenot's paper yesterday finished a little abruptly and beforeI had had time to say the few words that I wanted to say. I wanted to express my appreciation of the work that has been done by these surveyors in carrying on this line of investigation. Surveyors have carried on their work with great pluck and under extraordinary difficulties—difficulties, in fact so great, that some of them have lost their lives. We have with us today the father of one of the victims and I am sure that I am expressing the feelings of every member of the Association in tendering him our deepest sympathy. Something was said about the old suverys and the information that was available in the reports of the old surveyors. Those surveys were made under contract in the olden times. Of course, that information is not of much value and cannot be expected to be very valuable. It is much to the credit of the surveyors that it is as valuable as it is. But when you pay for information by the mile you cannot expect it to be of first rate value. If you engaged a lawyer you would not pay for his advice by the yard, or if you consulted a doctor you would not pay for his prescription by the square inch. But, taking it altogether, I think that much valuable information can be had from these old reports. However, that is not sufficient. We want something more. Something was said about roads and an instance was given of a road crossing a stream five times. That reminds me of an incident in the old times when we were revising the manual. We had to define the limits by a system of surveys. As you know, there are no road or section allowances through British Columbia. The question arose as to the roads around the section line at the boundary. It was pointed out that these roads were blind because they stopped abruptly at the boundary. The point was raised as to whether there should not be a road allowance along the boundary so as to connect these blind roads. I think you will find a report on that on the files. The most amusing part of it is that this boundary follows the crest of the Rocky Mountains.

A VOICE: That will be the high road.

MR. HENDERSON: This is a very opportune paper as such great interest is being taken in land settlement and land investigation, and it would be a fine thing for Canada if we could get a soil investigation started and carried on as they have done in the United States. The thanks of the Association are due to Mr. Johnston for bringing this subject before us. I hope the members will have his paper before them in the printed report and that they will study it and make use of it. I have much pleasure in moving a vote of thanks to Mr. Johnston for his valuable paper.

MR. KING: I have much pleasure in seconding the motion.

Motion agreed to unanimously.

ROADS.

A. H. Hawkins, B.A.Sc., D.L.S.

When honoured with an invitation to prepare a paper for the Association, naturally, the subject, was the first question presenting itself, and many topics were considered and rejected, but the subject of roads, appeared to be so fraught with the greatest of importance to the nation, and its universal popularity induced its adoption. It was decided to treat the subject in a popular, rather than a technical manner, the reasons for which appearing later, and when offering criticism, to make that criticism, in so far as I might be able to suggest, of a constructive and helpful nature, and while perhaps the building of concrete or hard surfaced roads, has not been within my sphere of action—I have had to lay out many miles of roads, through the hinter lands of Canada, when our chief aim was to secure the path of least resistance to our transport, and after all, taken by and large, this is the aim of the Good Roads builder of today, the difference being largely one of methods, materials and cost.

Since the beginning of habitation of this earth, the question of highways, has been, and is today, one of supreme importance to all branches of the animal kingdom, for the prime and most vital reason, that, food first, and secondly the climate necessary and desirable to existence in the most assured and comfortable manner should be made available.

Animals, birds, fishes, have always had well defined roads over which they have travelled from one part of the earth to another, impelled by the instinct of self preservation; to migrate to regions that were salubrious at one season and from the same, when climatic or other conditions became too rigorous for their comfortable existence. To humanity, highways serve precisely the same purpose, that they do to other animals. Since mankind has gradually gathered to cities and towns, it has become necessary to provide means of securing very large supplies of food for his sustinence and comfort, and to facilitate the transportation of these supplies, is to improve our highways.

At the present time, wheeled locomotion, is the method mostly favoured in overcoming obstacles to transportation, reducing the question to one of preparing a surface, that will offer the least resistance to the vehicle employed.

With this end in view, the pioneers in Canada cleared the timber from the right of way along proposed routes, in many places using the logs so obtained to build the famous corduroy to carry them over swamps and bogs, and carts and wagons bumped over the roughest of rough roads in the settler's efforts to place his products on the market, and to procure the few necessities he could not produce.

As time went on the main thoroughfares were gradually improved, by grading and draining, and highways were gradually developed. The system of statute labour was evolved, whereby owners of lands adjacent to the road were called upon to spend so many days annually, under the direction of the Pathmaster in the construction of new roads or improving and repairing those already existing—The system at first sight might appear to be ideal, but in actual practice, the results did not meet expectations, for the very good and sufficient reasons, that the Pathmaster was not as a rule, versed in the essential and necessary features required to be observed in the construction and maintenance of Good Roads; and while the statute labour system without a doubt in many instances resulted in material improvement yet on the whole I think it is admitted to have been more or less of a failure; so far as the construction and maintenance of the best form of highways was concerned.

Over the greater extent of Ontario and the West, the main roads have been laid out along the boundaries of lots, without considering the configuration of the ground, and while deviations have been introduced in places, still the fact remains that the best location in many cases, has not been adopted, and as a result the highways do not measure up to that standard of efficiency, that such an important part of our economy demands.

In passing it may be remarked, that while from a mathematical point of view, the rectangular systems of land survey, are doubtless the most convenient for the engineer, it would appear, that having in view, the contiguity of settlers, highways placed in the most suitable locations as to soil best adapted to roads, drainage and general contour of the surface, some other plan, might with very great advantage have been adopted, and it is a question worthy of the most mature consideration, whether in the building of the proposed main highways in Canada, these points should not, as in the case of railway location, be dominant factors in the determination of its final position.

It is to be constantly kept in mind that we are now to build *permanent roads,* not for ten years or twenty years, but like that very eminent engineer and road builder Julius Ceaser who constructed highways about the year 1, and whose roads are still being used, like him, I repeat, we must lay our foundations broad and deep—having constantly in mind, the idea of permanency, and that view does not mean the cheap method, but on the contrary, probably at the moment the most expensive.

Once the location of the right of way has been chosen, the questions of drainage and foundations, the most important part of the whole project are next to be dealt with, and in these matters, no time, care, or expense should be spared to have this portion of the work, as near perfection as it is possible for man to attain—Ditches and drains, must be so well constructed and so carefully laid, that it will be impossible for water to stand on any section of the road, as seepage is one of the greatest deteriants to stable foundations known, and unless the foundations be designed, and laid, to conform to the best planned methods, that modern or ancient engineering can devise, we are at the very start of our enterprise introducing an element of weakness and future trouble, that will follow the road so long as it may exist, and my own observations of so called modern roads, backed by much evidence leads one to conclude, that the weight of importance, is not at the present time given to this question of foundations, that is so vital and far-reaching in its effects, both as to the life and maintenance of the road itself but also to that decidedly important matter, the financing for its construction.

During the past summer, particular attention was paid to the appearance of the surface of so called permanent roads in several of our Canadian cities as well as on country roads, and the instances where defective foundations were indicated by the wave like appearance of the surface, at numerous points, would show the giving way of its foundations, and once this condition begins, the destruction of your road is within sight. Money for construction is borrowed for a given term, generally twenty years, but unfortunately the roads require rebuilding before that time has elapsed, the result being more loans for further construction, not but that the new investment and the old, were both in a sense profitable, but it is contended that better foundations should be devised, which of course means more expenditure, but this in the end, would as a practical, economical investment, be the better and more efficient method to adopt, and therefore it is suggested, that greater attention be paid too, and more efficient and more permanent designs for the foundations be worked out and adopted, as we are in most instances handing along the debts so contracted for the construction of our highways to those who are to follow; surely then it is but a fair proposal, that to offset these debts we should be able to hand them something in the way of an asset as against the liability.

With the greatly extended use of the motor truck, in conveying freight from point to point, the question of road foundations is sharply brought to the front. An ordinary hard roadway built under the present specifications is found to be most defective and in a comparatively short time is reduced to ruins, and that the motor truck has become a most important factor in the question of transport, and indeed it is reasonable to suppose will become more and more a feature in highway traffic, must force the most mature consideration, and the adoption of improved and more stable foundations, particularly on our trunk lines or National highways.

The Ontario highway authorities have from time to time conducted extensive experiments, as to the number of vehicles of different kinds passing over a certain portion of the road in a given period, and this information taken with the results of laboratory experiments of the materials used, form a basis from which designs are formulated; but in the rapidly changing conditions of traffic it is submitted, there is to be found, a dangerous and ever present element of weakness. May I illustrate my meaning? At the present time, heavy traffic is largely carried on by one or two horse vehicles travelling at a rate of 3 to 4 miles per hour, the heaviest load probably not exceeding 3 to 4 tons; and comparatively few motor trucks are being used, but their use, and the great advantage to be derived therefrom, is being daily more and more exemplified by our cousins to the south, and fleets of trucks are carrying all manner of commodities, from place to place, wherever the condition of the highways will permit, and there is little doubt, but that this means of transportation will come more into use. Now then the conditions become quite different, than those for which our road was designed—the loads were 1 to 4 tons and the speed 3 to 4 miles per hour—but with the motor truck the load may be anything up to 10 or 15 tons, and the speed anything up to 30 miles per hour. The consequence are at once obvious to the most casual observer. A road designed to meet the earlier conditions, will, when subjected to the much heavier and more rapidly moving motor trucks, I fear, suffer the most serious consequences and therefore my plea is for a careful and comprehensive study of this subject, with that vision of the future, that the designs adopted, may meet a large percentage of the estimated life of the road.

At the same time that designs for the permanency of the road are being carefully worked out, authorities are beginning to recognize the fact, that a limit must be placed on the loads to be carried, otherwise, no matter how well, or how carefully formulae are prepared, a load or loads might at anytime come along, that would seriously damage the highway and it has been suggested that a sensible test for the load limit would seem to be so much per tire inch, and this would be further controlled or adjusted according to districts, in addition it would be quite proper to specify that no axle shall bear more than a certain load, and that no two axles, shall be more than a certain number of inches apart.

Experience has also shown, that a tire not subjected to tractive strain, need not be more than half as wide for a given weight, as one that is subject to such a strain.

All of these points and many others, bear most materially upon the question of Good Roads and the commission having the matter in hand have some most intricate and interesting experiments to carry out, before they are finally able to supply the definite data and designs necessary to the establishment of permanent roads.

The question of maintenance of the road, if one is to judge from the appearance of most of our highways, seems to be sadly neglected.

Many authorities seem to feel, that their responsibilities end with construction, whereas details for maintenance should be worked out and set in motion with the road's completion. The old adage, "a stitch in time," is peculiarly applicable, and unless arrangements are made, and promptly carried into effect, to repair, whenever and wherever required, the life of the road is materially lessened.

The continued propaganda for Good Roads, and the adoption by the authorities of this most worthy object, is timely and to be most heartily commended, but the danger of neglecting some of the salient features, necessary to the success of the project, is greatly augmented by the universal enthusiasm evolved, by the admiration and wholesale adoption of the one side of this great question and that is, "Let us have them."

My plea is in no way to be taken as an attempt to curtail or check so wise and universally beneficial a movement, but I do plead, that we are laying much of our so called permanent highways, without that due regard and consideration, that the writer thinks should be exercised, to secure the best results. As yet the matter is largely in an experimental stage. Formulae and designs are derived from experiments that are not exhaustive and have to be rearranged all of which costs money—and to save, has been, and should be a Canadian Slogan for some years to come, if we are to successfully cope with our huge war debts, and look after our returned soldiers.

I have not gone into the numerous formulae worked out by different good roads commissions for the reason that as yet we are still in the formative period, and have no standardized designs—At the present time, the matter starts with Municipal Councils, the County Councils have a hand. The Provinces are eager to help in so popular an undertaking, and now the Federal Authorities are to become interested; and however well all are intentioned, with such diversified interests, I fear that we shall not have that co-ordinated effort that is absolutely necessary to ensure success to so great and so important an undertaking, and I beg to suggest that Governments should without delay get the Engineers together to work out and formulate standard designs, that will meet the demands and requirements to carry to success a scheme so fraught with the welfare and prosperity of the whole community.

We have ascertained that we can raise hundreds of millions of dollars when necessary and surely it is admitted, Good Roads are a necessity, therefore let the politician and financier raise the funds, organize a National Commission of the best Engineering talent available, that shall have guiding, directive and instructive authority, and allow the Engineer to build the highways without political interference. In this era, when reconstruction is acknowledged to be necessary and is welcomed by all classes of our citizens, may we not be big enough, and have the broad minded outlook, that will enable us to abandon our emergency methods at present in vogue, lay our foundations deeper, wider and more truly permanent, not for today alone, but for the future, and in so doing not only call for, but merit the approval of those who in a few short years, are to follow, and hold the places that we now occupy. Let us make haste slowly in this transitory age of reconstruction.

Permit me to recapitulate the more important points that it is desired should be kept in mind.

1st More attention to the careful location of main highways.
2nd More attention to drainage and foundations.
3rd Universal standards for road construction.
4th Universal regulation of loads.
5th Prompt and careful attention to maintenance.
6th Careful selection of the best Engineering talent available, *and leave them alone.*
7th No political interference with either location or construction.

But it may be asked, wherein is the Association or the Dominion Land Surveyor interested in these different aspects of this very great and very interesting national subject, and I beg to submit the following suggestions.

He is, as a citizen most vitally interested as the project calls for large expenditures of public money.

The Association as a representative body of one branch of Engineering should be and is, if alive to its responsibilities and duties, most deeply concerned with such a proposal, as it calls for the exercise of the most ingenious and farseeing skill to successfully overcome the obstacles that confront the question of highways, and such a body may very properly be expected to offer suggestions and advice on a subject of such vital and national importance.

Being immediately under the direction of the Federal Authorities, and it being proposed to spend considerable sums of Federal money in the undertaking it surely could not be considered improper to place such trained service at the disposal of the Government.

So far as location of lines, levelling and mapping, of the proposed highways are concerned, the Dominion Land Surveyor is eminently qualified by both training and experience to lend a hand in so important a project and since the proposal is to be national I beg to submit that no narrow restricted or selfish ideas should be permitted to exclude so important and well qualified a body as the members of this Association from the actual working activities of this great undertaking.

During the reading of Mr. Hawkins' paper Mr. George Hogarth, the Engineer of Highways for Ontario, entered the Hall, and, at the conclusion of the paper, was introduced by the Chairman.

Mr. Hogarth: Mr. Chairman and Gentlemen, I regret that I did not hear the early part of Mr. Hawkins' paper. But the part I did hear was exceedingly interesting to me and I appreciated very much what he said. When I arrived he was commenting on motor trucks and the effect that these trucks are having on our roads today. We have operating in the City of Toronto today possibly motor trucks and steam lorries as heavy as are to be found anywhere. We have trucks weighing from five to seven tons, the ordinary load is twelve tons and they frequently overload to fourteen tons. That is too heavy a load for the class of pavements that we have in Canada today. The owner wants to operate his trucks twelve months in a year, because the last three months of the twelve furnishes him with practically all his profits. We have today operating on the Toronto-Hamilton highway trucks of a capacity of from two to five tons and we are liable to see anything come along from a steam boiler with a clearance of fourteen or fifteen feet to an ordinary package of freight. That heavy type of paving is the only road surface which will carry, during twelve months in the year, when the truck owner is bound to operate, a truck of this size. The lighter forms of pavement will not stand it; so that we will have to put in a heavier, thicker, and more durable surface if we are going to meet this heavy truck traffic.

If we do that we have to face an expenditure of which possibly few people realize the proportions. It will be a big expenditure. At the same time we cannot do it with a small expenditure and try to stretch it all over the province. The roads that are built must be built right and they must be kept in condition for twelve months in the year or you will very likely require to reconstruct them.

With reference to Mr. Hawkins' remarks about a standard design, I would say that it is possible in city paving in certain localities to develop a standard design; but, to take a standard design and apply it all over the country, or apply it even in a certain locality, or within a certain range, would, in many cases, lead to unfortunate results unless that design was applied by men well acquainted with road building. Soil conditions greatly affect the type of road you have to build. You might have a pavement on a street in any town in Ontario with three inches of crushed stone, and the road might carry the traffic that goes over it, but to put down such a pavement under other circumstances, or in a different location, would only invite failure. It would not stand up. At the same time the question of standard designs is a very important one for the reason that a standard design might be used for three-quarters of the mileage of the pavements that we build. As Mr. Hawkins, in winding up his paper, said that Dominion Land Surveyors were qualified to handle this work, I would point out that this is the sum and substance of the whole business. After the design is got out you must be sure that it is applied and used by men who are acquainted with the construction, wearing qualities, and serviceability of the types of road that have been in use.

We have again the question of loads and the limitation of loads. I do not think that there is made in Canada today a motor truck that is universally used. Our trucks are made outside of Canada, although some of the makers are producing a small number in this country. You might say that the trucks used here are foreign built; in other words, the loading that these trucks are made for is settled before they are imported into this country. In the United States today they are putting forward certain legislation to fix the maximum load for a motor truck. Once the maximum load is set by law it will give the good roads designer a definite basis on which to design his road. He will then build his pavement to carry the legal load. As it is now you may have a change in the load next year. A truck maker may find it necessary to increase the load and immediately a change in the pavement has to be made. I understand that the United States Bureau of Public Highways had proposals from a truck maker for a truck with a capacity of something in the neighborhood of 30 tons and with steel tires. That would smash any road that was ever built and they found that their roads would have to be three or four times as heavy as they are now to carry a truck of that kind.

The question of maintenance is a very important one. With the type of pavement or road that is built in Ontario today, it is only one or two years after the road is constructed before extensive repairs, and possibly replacement, must be undertaken. Before the Toronto-Hamilton road was completely finished, the maintenance men were out seeing that everything was in order and that any little difficulties that had developed were properly looked after. That is the secret of keeping our roads up today. In the past, due, you might say, to the authority being spread out and not direct enough, maintenance has been very greatly overlooked. Two years ago in the Province of Ontario the municipal councils were authorized to maintain their roads, but prior to that the maintenance was undoubtedly neglected. A road was built and it was allowed to wear out and when it wore out it was considered ready for rebuilding again. Keeping up the road was not thought of at all. The steady traffic that is going over our roads every day, principally in southern Ontario, is what has forced the maintenance of highways on the attention of the authorities. We have to do as they do in the older countries and that is to look after our roads for twelve months in the year.

Mr. Hawkins referred to the location of the roads and, speaking from the point of view of the provincial highways we find that there is one requirement that has to be recognized and that is that the roads have to serve the people. In other words, they have to go to and from the towns and cities where the people are living. It is not advisable to construct roads through portions of the country where people are not living. The location of the C.P.R. was fixed, over a great portion of its length, by the settlement which then existed in Canada. The roads must serve the people, and they must pass through the centres of population.

Mr. Hawkins also referred to drainage and foundation. When it comes down to actual road-building, there is nothing more important than drainage and foundation. There have been miles and miles of road all over the country that have simply gone to pieces in a short time due to the fact that adequate side ditches and proper tile drainage were entirely eliminated in building these roads. We have here six weeks in a year, three weeks in the spring and three weeks in the fall, conditions that are peculiar to a cold climate that practically render many of our roads unstable. If, under the surface of the road, moisture has frozen, you will find in the spring such a condition existing as would damage any road and if it is an earthen or gravel road it soon becomes impassable. With proper side ditches and tile drainage it is possible to maintain a fair gravel road or a road going through ordinary soils.

In reference to Mr. Hawkins' statement that Land Surveyors are peculiarly fitted to carry on this work, I think I can only point to one D.L.S. in Ontario who is employed in connection with road building at the present time. We have a number of O.L.S. men employed and we find that these are the best class of men that we can possibly get to put in charge of that work. We have O.L.S. men employed by county councils looking after county work, and on our own provincial highways we have a number of these men employed on the surveying end of it. As the work progresses more will be employed because it is a work for which they are well fitted.

MR. DENNIS: I think that Mr. Empey, who is on the Ottawa-Prescott road, is a D.L.S.

Mr. Seymour: We are very much indebted to both Mr. Hogarth and Mr. Hawkins. This question of roads is a very important one from the standpoint of the land surveyor. Mr. Hogarth and Mr. Hawkins have spoken of conditions which probably obtain more in the east than elsewhere. I would like to say a few words on the conditions in the West, with which I think Dominion Land Surveyors are probably more familiar. I believe the figures show that in the older parts of Canada and the United States ninety per cent of our roads are still earth roads and we can never expect in the West anything better than earth roads for a long time to come. In a few localities they have some stone and gravel roads, but, generally speaking, in the West you must depend on the road material that is at hand; that is material from the side ditches or from the balancing of the cuts and fills. I think that is an important point to be borne in mind in connection with road development in the West.

We have with us this morning Mr. Wright who has spent some time in Saskatchewan and who will tell us how they have dealt with the road system there. Road systems are being developed in Manitoba, Saskatchewan, and Alberta. In Manitoba a Good Roads Act was passed in 1914. The purpose of this is primarily to develop market roads. Help is given to municipalities to construct roads; one-third of the cost of earth roads and one-half of the cost of gravel roads is borne by the province. In Saskatchewan the Highways Department is responsible for the location of roads and these are called out in co-operation with the municipalities. In Alberta they have recently passed a Public Highway Act and it is to go into effect in January. There are three classes of roads—main, district, and local, and in connection with all, except the last, the local authorities are helped out to a greater or less extent.

Reference has been made to the fact that our roads are located on road allowances which, as a rule, have been surveyed without any reference to the topography. I understand that in western highway practice, where the grade is not greater than seven per cent, the road is usually located upon the road allowance, but that if it is greater than that a diversion is made. Mr. Wright can probably tell us as to that.

It seems to me that the first consideration in connection with main roads is that the haulage charges shall be decreased. The haulage charge should be made such that a greater number of points are brought nearer to the business centre. If the haulage charges are decreased, farms that previously had made no returns, will, as a result of the construction of a good road, give a return of several dollars per acre. That is an important consideration in connection with the construction of highways. I wish again to thank the previous speakers, and especially Mr. Hogarth, who has so kindly addressed the meeting.

Mr. Wright: After the very comprehensive discussion we have had on highways I do not think there is very much left for me to say. My experience has been confined to Saskatchewan and it has been somewhat limited as to that. In Saskatchewan we have as yet no permanent highways of the kind that have been discussed this morning. They are mostly all earth roads and are likely to remain so for some years to come. But the earth road possesses important possibilities when developed along proper lines and given proper maintenance, drainage, etc.

I would just outline a part of the history of good roads in Saskatchewan. As far as I have been able to find out, previous to 1912, there was no well thought out plan of road development in Saskatchewan. In 1912 a Board of Highway Commissioners was formed and an attempt was made to lay out on paper a system of main roads, or roads designated as main roads, throughout the province. Road and bridge gangs were employed by the Government to work on these roads and large sums of money were spent. These gangs became fairly efficient, but oftentimes their energies were misdirected, due to the lack of even an elementary knowledge of road construction on the part of their overseers. I have frequently seen roads built across sloughs at great expense when a ditch a few hundred feet long and a couple of feet deep would have drained the sloughs entirely. I need not say that the cost of maintenance was greatly increased because the road-bed was constantly saturated with water. The method of administration under this system was also somewhat at fault in that it lent itself too readily to official corruption and in 1916 we had the Saskatchewan road scandal as a result of which at least a couple of prominent Westerners had their activities restrained at that time.

In addition to the work done by the gangs at the Government expense under this system there was also what was known as the dollar for dollar system; that is, for every dollar spent by a municipality on main roads, the Government granted them an equal amount and the work was carried on by the municipalities themselves. The work done under this system was in a sense the same as under the system I have previously mentioned as regards the Government gangs, in that a knowledge of road engineering was lacking and we had a patchwork system of roads. The councils were only elected for a year and as each succeeding council was elected the roads for that particular season were generally constructed in the neighborhood of some particular councillor.

In 1917 the Department of Highways was formed to undertake the administration of road development in Saskatchewan. The province was divided into eight districts and each district was placed in charge of a road superintendent. The roads, under the new system are built entirely by the rural municipalities themselves either by day labour or by the contract method with grants from the Government with the stipulation that the grant be restricted to the development of the main roads. The only work now directly done by the Government is bridge building. Their activities are restricted to the larger bridges, crossing the larger streams. These bridges are built by bridge gangs who, through continued experience, are becoming quite proficient.

Under the new system the rural municipality also gets a certain proportion of money from auto licenses to be used in the maintenance of existing main roads.

We have made great strides in road building in Saskatchewan in the last three years. It is due in part to an improvement in the financial standing of the municipalities themselves, but incidentally to the greatly increased use of automobiles on farms in the West. In some of the districts nearly every farmer owns his automobile and they have begun to see the necessity of good roads. They could get through a road with a wagon and a team of oxen that they cannot travel over with a car even if it is a Ford.

The result of this has been that many of the municipalities have been employing qualified engineers to make a study of their roads and to submit a plan of development, due regard being paid to topography, traffic conditions and the fertility of the soil in various localities. I may say that it is in this particular work that I have been engaged until very recently. A very careful study of all the factors entering into a system of roads is laid out on a map.

The question was mentioned some time ago about the relation of the Dominion Land Surveyors to good roads. Mr. Hawkins has touched upon that. I think the relation of the Dominion Land Surveyor to good roads is closer in the western provinces than it is in the east; at least it has been so in my experience. I might say that in the planning of diversions from existing road allowances around obstacles the work is carried on by Saskatchewan Land Surveyors and many might think that all that is necessary is for the Saskatchewan Land Surveyor to go ahead and survey a road in Saskatchewan. But, that is not the case. Many of these diversions around sloughs, lakes and so forth, go directly through fractional portions which still remain in the crown and which a provincial land surveyor cannot survey unless he is also a D.L.S. The result is that practically all the provincial land surveyors have to be Dominion Land Surveyors also.

Mr. Barber: Mr. Hogarth, referring to the heavy motor truck traffic, said that he hoped some definite limitation would be placed on these loads. I presume also that they expect that this heavy motor truck traffic will be limited to certain roads and streets. It would obviously be too expensive to build every road up to a standard that would withstand this unusual trafic.

Mr. Hogarth: It is undoubtedly in the order of things that certain roads should be designated as traffic roads; otherwise we would have the trucks breaking up roads which were not constructed to carry these loads. That is under consideration at the present time. With respect to the limiting of loads, we have an Act in Ontario today which limits a load passing over a highway to 12 tons. I hardly think there has been a prosecution under that Act to date; so that, a man buying a motor truck has really nothing to deter him from buying the biggest truck he can handle, provided he can get away with it.

This concluded the morning session.

LUNCHEON AT THE CHATEAU LAURIER.

The members of the Association and a number of distinguished guests met at luncheon at the Chateau Laurier at 12.45 p.m. and the event proved most interesting and enjoyable. The President, Mr. Wallace, presided, and on his right hand was the Hon. Arthur Meighen, Minister of the Interior, and acting-Minister of Justice, and on his left hand was the Hon. Dr. Roche, formerly Minister of the Interior and now Chairman of the Civil Service Commission.

At the request of the President the Secretary-Treasurer, Mr. Henderson, presented regrets at their inability to attend from the Hon. A. K. Maclean, the Hon. J. A. Calder, Mr. C. A. Magrath, Mr. W. J. Stewart, the Hon. J. P. B. Casgrain, Mr. R. H. Campbell, Director of Forestry; Mr. J. B. Harkin, Commissioner of Parks, and Mr. Noulan Cauchon, C.E.

The Geodetic Society was represented by Mr. Thomas Fawcett, the Ottawa Branch of the Engineering Institute of Canada by Mr. Corriveau, and the Ottawa chapter of the Architects' Association by Mr. R. H. Millson.

Mr. Wallace: I have much pleasure in asking the Hon. Mr. Meighen to address a few words to us. Mr. Meighen not only has charge of the very important department under which we have the privilege to serve, but he is an outstanding member of the legal profession. I think it is very much to be desired that members of one profession should have the privilege of being addressed by members of another profession. There is one matter which seems to affect surveyors somewhat peculiarly, and that is the difficulty they have in impressing other professions with the importance of their calling, and inducing them to take the view which they themselves take of their own line of work. That is a condition that has occurred to me as being very remarkable. On the other hand, when the legal profession makes up its mind as to how certain things are to be done we somehow seem to take their view, although other professions will not take our view as to what should be done in our profession. Mr. Meighen should be very popular with surveyors for a remark he made here last year. I had not the privilege of being present, but I read the report. He said that in the old days in private practice he employed quite a number of surveyors, and he always considered that collecting the money to pay the surveyor was very much more important than collecting his own fees.

Hon. Mr. Meighen: Mr. President and Gentlemen, when the subject of this luncheon was brought to my attention in the form of the kind invitation which you had extended to me, I thought it would be better judgment on my part if I permitted the assembly to hear another member of the Government, in order that it might have an opportunity of studying at close range the many-sided excellencies of the present administration. But, for the reason given by the Secretary, Mr. Maclean, has been unable to attend, and at the last moment I have come in his place.

I remember speaking a year ago at this same luncheon and I also remember, as a result of some of my remarks getting to the press—not through the accurate medium of the reporter but by some unjustifiable method,— a very considerable amount of criticism coming down upon my own much abused head in consequence. However, those things never deter one. One just gets through one experience to confront the next and he becomes accustomed to them in time.

I was quite interested—indeed very much interested—in the kind introduction of the Chairman and particularly in the remark in which he referred to me as an outstanding member of the legal profession. It is some years since I have heard any reference of that kind. It is only a few days since that I was entertained by the Benchers of a Law Society and I listened in vain for any expression of that kind from them.

For a few years I practised law. I made of it a moderate success financially. I was engaged, as your Chairman says, chiefly in collecting the fees of the members of other professions that I had to employ in order to win a percentage of my cases. But I did succeed in one instance in gaining considerable recognition and I might just as well explain how I did it. I was defending a man charged with murder and I had pleaded insanity in his behalf. After a trial of many days, in which there were many discrepancies and when the outlook was dark indeed, I managed to address the jury for an hour and a half and they returned a verdict of "Not Guilty" on the ground of insanity. I learned from them some time afterwards that they had observed my client sound asleep through the entire course of my address and they came at once to the conclusion that he must be insane.

I know of little that I could say that would be of interest to you professionally, or from any standpoint peculiarly your own. The Department of the Interior, has, it is true, under its charge, the activities of the Dominion in the line of surveying. You are all aware that of recent years I have followed the precedent so well set by my friend, Dr. Roche, of retrenchment in surveying because of the necessity of providing for war expenditures and also by reason, to some extent, of the curtailment of the supply of efficient men, the profession having responded very nobly, and very generously, to the call to arms. We are now, of course, confronted with a rather different position. I am just informed that there are, even in this assembly today, a number who have returned from the front. To them, on behalf of the Government, I extend a word of welcome and a very sincere word of gratitude. There are to return a number more, I am told, extending into sixty and beyond that, who formerly were employed in the Department, who have served in the War and whom, I would at least like to see, have the considerate treatment that we are trying to accord to all returned men, particularly to those who were in our service before the War.

The question that comes to us from that standpoint, as well as from others, is what shall be the scope of our operations in the months and years immediately in front. We have undertaken, as you are aware, a plan of reclamation. So far it has been confined to drainage. You are likely acquainted with the fact that, extending over the last two or three years, negotiations have been carried on with the provincial administrations looking to the division of responsibility in this situation as between the Federal Government and their governments. We have concluded those negotiations and legislation carrying into effect the system of division established is being passed on the basis of which we are enabled to launch out upon some of these projects.

We, of course, purpose to attack first those that promise the least chance of failure. Whether or not along that line there is any hope of very extended operations I would not care to say. I was favoured just the other day with a paper prepared by a committee of your number—I do not know who the committee were—on the subject of the reclamation by other means, inclusive of drainage, but chiefly by fires, of Dominion Lands in Western Canada, lands, which in their present condition, are not attractive to the settler but which, it is claimed in the paper, might readily be made so by reclamation methods. The paper was indeed an excellent one and indicated to me a very close study of the conditions. It was evidently prepared by men who had a considerable acquaintance with the more remote regions of our Dominion lands in Western Canada and its contents will receive on my part the most careful study.

I do not know whether it will be found advisable to launch upon any plan of reclamation by the use of fire. Should that plan, however, appeal to us as being practicable and necessary under the conditions it will, of course, require supervision at the hands of men of your Association, or of your profession.

In this connection may I say that it would be folly for us to look forward to any reclamation methods whatsoever as a means of providing immediate land for the returning men. They are coming back sooner than we had been able to anticipate of recent months and any land reclaimed by drainage, or irrigation, should such be done, will be of a character that cannot, for some considerable time, be rendered remunerative for farming purposes. We all know the nature of land after reclamation by drainage. It has lain under swamp for years and the soil requires the effect of the sun's rays for some time before it becomes very useful for agriculture. Consequently, while we do intend to try to recover a substantial area of land in our country by reclamation methods, we do not look upon it as of itself a very great factor in the procuring of land for our returned men.

I am very much pleased to see that we have with us our predecessor in office, the present Chairman of the Civil Service Commission. It is some months now since I had the pleasure of seeing him, and listening to his eloquent words, and, although time is scarcely less precious for me than for some others who were not able to come, it is not so precious but that I will be able to wait and listen to his address.

I am glad indeed to be able to be with you, it is an honour that I appreciate and I hope that when my association with the Department ends, and consequently my association departmentally with yourselves, it may not be said that anything but fairness and courtesy and all possible consideration were meted out at my hands to your requests and to your needs.

The Chairman remarked that the legal profession extended an influence over other spheres of life to a degree that was not accorded to the profession of surveying. Well, the legal profession frequently exercises its views with considerable momentum, but I have found this, that the world in general affects to know a great deal more of the legal profession than the legal profession would affect to know of other walks of life. We have to overcome first of all the great barrier of prejudice. We have, as courageously and skilfully as we can, to surmount all that stands in our way. I am quite aware that in politics it very often turns out that many of the major offices of state are held by members of the legal profession. The reason is obvious; at all events the explanation is obvious, whether you acknowledge it to be an effective reason or not. The purpose of legislation, after all, is to provide machinery for the enforcement of the laws that exist and to provide new laws for new conditions that obtain. It is not hard to understand that the advantage would accrue in the conduct of work of that kind to the man whose life had been spent in the study of the laws as they are. That is inevitable. I do not think it argues aggressiveness—much less selfishness—on the part of the members of the profession.

In the United States of America, one of the great democracies of the world, it seems to me that ninety per cent of their presidents have been chosen from the legal profession. It is not all due to the prevalence of any preference on the part of the people for a lawyer but it is just due to the fact that men in the profession who had the other qualifications as well came to the front with an advantage that did not belong to the followers of other walks of life.

The conclusion of Mr. Meighen's address was marked by a spirited and enthusiastic outburst of applause.

The Chairman then called upon Dr. Deville, the Surveyor-General to address the company.

Dr. Deville: Mr. Chairman and Gentlemen, I am sure that everyone here was delighted to hear the very sympathetic remarks made by our Minister. It is a great comfort for us to have the privilege of serving under a man of such broad understanding and one who can realize so well as he does the necessities of the profession. We are now facing a new situation; we are coming out of the war with an enormous burden of debt and with very great obligations. How to meet and deal successfully with that situation will require the best efforts of everybody. Among the subjects that the surveyors are more intimately connected with is that of land settlement and the surveyors believe that their services can be of great assistance in carrying out such a project in the most efficient and satisfactory way. When I say "efficient" I mean the elimination of useless work, of work that is not productive.

We must realize that conditions are greatly changed in the West. There are no longer free prairie homesteads. The districts in which there are free lands are generally wooded. There are big tracts of muskegs which are not fit for settlement. There are barren tracts, there are rocky tracts, there are lands heavily timbered and other lands lightly timbered which might be easily cleared. The only roads through that country are rough trails cut by surveyors for carrying their outfit. It is that land which is now offered to settlers. They are told: Here are the lands, help yourselves! What has the prospective settler to do now to select his land? He has to make an exploration. He will pass many lands which are quite unfit for his purpose and he may be wandering for days and days before he finds anything that is worth while. Every other settler who goes in has to go through the same experience; he has to undertake an exploration. If there are 20,000 settlers there will have to be 20,000 explorations. Surely that is a situation where useless work can be eliminated? Why not have one exploration which will serve for all the settlers? Have all the information collected about the land, all the information that can be of value, and place at the disposal of the settler all this information and give him the assistance of experienced agriculturists, chemists, soil experts, and so on. Have your lands classified so that the man who wants to engage in dairy farming can find the land that is fit for that kind of farming. That would save a great deal of useless work. I do not mean that the settler should not look at the land before making his selection but he can confine his inspection to lands that are suitable for his purpose. It would save him the loss of time in going over land that did not meet his requirements.

This is not the place—and it is not my intention—to lay before you a policy of land settlement but there are a few broad principles about which there can be no difference of opinion. What is necessary to make a prosperous farming settlement? We may say that in the first place, it must be compact; that is to say, there must be no waste land, no vacant land in the settlement. The next requisite is that the land which it is proposed to develop must be of a certain size so that the community can afford the expense necessary for making the improvements that are required. Another condition is that the land must be quickly occupied so that the settlement may emerge as soon as possible from the incipient stage. The two first conditions can be met by a proper selection of the district to be colonized. That can be done by means of the information collected by surveyors. The other condition, that of quick settlement, can be realized by limiting the amount of land opened for settlement. If you open for settlement just enough land to meet the demands of settlers within a reasonable time, you will be sure that your land will be quickly filled up.

Another need of the new settler is a road. You must have a road to go from the settlement to the nearest railway point. The policy of building new roads only after the settlement has been in existence for some time looks to me like putting the cart before the horse. You want the road in order that the new settlers may take in their implements, their provisions and everything they require without too much waste of labour and time. Think of the awful difficulties of the poor settler who has to go over one of these surveyor's tracks, wading through swamps and across streams, carying only one-tenth of the possible load and making five or ten trips when one ought to be sufficient. Is there no remedy for that? Is it not possible to eliminate that useless work?

In every new settlement you want sites for schools. You will want a saw-mill and that saw-mill will require a timber limit not too far away so as to supply the needs of the settlers. Each new settlement should have its timber limit, to supply the needs of the community instead of the settlers having to pay toll to the owners of timber limits. You want a creamery, a cheese factory, or something of the kind. There will have to be a general store, a blacksmith, a carpenter, a livery stable, and so on. This means a town site. You will have to lay aside some land for these purposes and for churches, cemeteries and so on. All this should be laid out before the settlement is formed and the money derived from the sale of land should go to the benefit of the community which has created the value of these lands instead of it going to the townsite speculator.

I am only giving you in a general way some of the requirements of the new settler. I might continue in that way for a long time but I do not want to weary you. The fact of the matter is that the surveys, as they are at present made under the law, are not sufficient to meet modern requirements. Something more is required. We require a more complete survey to meet the conditions of the present. I have been speaking only of new settlements but I could extend my remarks to the older settlements too. More information is necessary for the proper development of the country. These ideas are not peculiar to me. They are coming to the front under different names. You can call it town-planning, or rural planning, or anything you like, but this is the modern idea among those who have given attention to this subject and it is sure to be realized. It may not come in my day, but it is sure to come at some time.

The Chairman paid a graceful and sincere tribute to the Hon. Dr. Roche, referring to his long-continued friendship for the Association, the great ability which distinguished his administration of the Department of the Interior and his interest in everything calculated to promote the prosperity of the West. Dr. Roche, on being invited to address the company, said:

Hon. Dr. Roche: Mr. Chairman and Gentlemen, when I had the honour of being the head of the department of which the Surveyor-General's branch forms a part, like my illustrious successor, I considered it my duty as well as my privilege to be present at your social functions held in connection with your annual convention. It was a duty because I felt that I should acquire as much information as possible regarding your work in order that I might be in a better position to discharge my own duties as head of the department by bringing myself in contact with the members of your profession. I realized that I would be able to work in co-operation with that branch of the service to a far greater extent than if I absented myself from these very pleasant and valuable meetings. I am glad to see that my sucessor is following in my footsteps. I considered it also a privilege that I should have the opportunity of spending a pleasant hour in a social capacity cultivating the personal element and establishing those harmonious relations which are so essential as between the head and body of a department.

Since I have severed my relations with the Department of the Interior, you have been kind enough to continue these invitations to me. I have looked upon these invitations as an opportunity of being present not so much as a duty but as a privilege and the consequence is that I am always with you.

We are assembled to-day under much more happy auspices, under a feeling of brighter optimism and with lighter hearts than at any time since your assembling in the winter of 1914. The war cloud which enveloped the world and cast a pall upon civilization has been dispelled suddenly, satisfactorily and greatly to the relief of mankind. During the past four years wherever there was any gathering of our people, the one great theme of discussion was the war. War filled the air. Since the signing of the armistice the popular theme has been reconstruction, repatriation and the restoration of our soldiers to civil life. The primary duty in connection with this task devolves upon the shoulders of the politicians and the statesmen in whatever category the different aspects of the question may come. It is not my intention to impose my views, no matter how attractive the subject may be, upon this assembly and I shall not undertake any detailed discussion of that topic. Still, I feel that I have a personal duty in connection with the question, because I feel that we should not leave to Governments, either Dominion or Provincial, the sole task and the sole responsibility of dealing with these vast problems.

As the Minister of the Interior has so well put it, the members of your profession have nobly responded to the call. During the past four years you were largely represented in the firing line and you are in a position to give very effective service to the state in connection with the work of restoring the pre-war conditions and especially in connection with this most interesting topic that has been referred to by the Surveyor-General—the settlement of our soldiers upon the land. I understand that your services have been freely tendered and as freely accepted and, therefore, there is a splendid field opening up for your activities in connection with these important problems.

Our soldiers during the past four years have achieved many notable victories and many meritorious distinctions have been received both from the British military authorities and His Majesty the King. I was reading some statistics a short time ago—and those statistics have been added to during the past fortnight—of the distinctions that have been conferred upon our Canadian soldiers. I find that they had won during the war, forty Victoria Crosses, the highest military distinction conferred within the British Empire; 491 D.S.O's; 1659 Military Crosses; 6549 Military Medals and 1628 D.C.M's. These distinctions have been won by our Canadian soldiers in addition to Italian, Belgian, Russian and French decorations. In addition to that we must not overlook the 15,000 wives whom they have peaceably annexed during the time they have been overseas.

Team work won for us the war and team work is just as essential in order that we shall win the greatest success in solving the problems with which we are now confronted. We have now before us a task to perform, one called by a longer name than war, one that it is more difficult to visualize, one that, at first blush, is not so interesting and one that is not calculated to arouse the same amount of enthusiasm on the part of the people, but, notwithstanding, one towards which it is just as necessary to direct our energies and efforts as was the war itself. During the past four years we have been under the exigency of subordinating our personalities and interests to the common good. Now, the period of reconstruction should be the first thought and duty of the Canadian people. Our interests, our ambitions and our dignities should take a secondary place. The man or woman, or the organization, be it private or public, which desires at this time and in this connection, to play a lone hand has no proper place in the life of our country. Government actions under a democracy can go but little farther than the will of the people themselves and that means the will of the men and women who go to make up the state. Government machinery, be it ever so effective or expensive can only work under the stimulation of co-operation. Co-operation is the oil which makes the machinery go smoothly and satisfactorily. Therefore, I would say: Let no man criticize, who is not willing to help. It requires our Canadian citizens, in connection with this work, to have faith in themselves, to have faith in each other and in Canada. If we wish to realize the moral fibre of the Canadian people, all we have to do is to recall the fact that 500,000 of our sons were willing to give their all on behalf of an ideal and that, in itself, should be an example for us in the years that are to come. Our soldiers were given a most difficult and heavy task but they have finished their work magnificently. We also have a task to perform and these achievements of our soldiers should prove an inspiration to us to grapple in the most resolute and intelligent manner with the problems now confronting us.

To a Canadian, the early history of our country, especially of western Canada, and of its progress and development, is of the most interesting character. I mention western Canada not merely because of the fact that I am a westerner. Many years of my life have been spent in the West. I have lived there since the early eighties and therefore I know something of the vicissitudes of pioneer life in that country. I also refer particularly to western Canada because of the fact that the members of your profession have had a great deal to do with the opening up and development of that great western country. You have been, so to speak, the missionaries on the outskirts of civilization, blazing the trail for the oncoming settlers, delimiting the boundaries in order that there should be no conflict of claims and doing this great work under hardships and privations that were sufficient to almost daunt the most resolute and courageous.

It is true, as has been stated by the Minister of the Interior, that your work has been somewhat restricted during the past two years. The first cause probably would be that there was not the same necessity for continuing your work in those outlying parts of the country by reason of the fact that immigration had practically ceased. This curtailment also arose from the fact that it was necessary to conserve our resources to win the war and to practise economy. But I am satisfied that, especially after the first year following the signing of the Peace Treaty, and after shipping facilities have been released, and the troops are all home from the front, we will have again a tide of immigration into Canada which will necessitate an increase in your labours in this connection. It has been the experience of European countries which have been at war in the past that war has been followed by a large measure of emigration from those countries. Undoubtedly, some of those countries which have been at war may impose restrictive legislation to prevent their people from emigrating and to restore their countries to pre-war conditions; yet, in spite of this, I feel confident that the experience of the past will be repeated, that they will come to this continent of America and that Canada will be the field of attraction.

I noticed by yesterday's paper that the United States are very likely to pass a law prohibiting immigration into that country, except from a comparatively few countries, for the next four years. Therefore, it seems altogether probable that Canada will be the great attraction for overseas immigrants.

During the period of unrest following the South African war, of the 259,000 people who left the British Isles in one year, 123,000 emigrated to the United States and were lost to the Empire.

While the British Government has a very effective land settlement policy of its own by which millions of acres of grasslands have been brought under cultivation, originally for the purpose of increasing production during war time, but which will be utilized for the purpose of restraining their own agricultural population from emigrating, still I feel that in spite of that, there will be very many desiring to come to Canada, led thither no doubt by the advertisement which Canada has received at the hands of her soldier boys who have placed the name of Canada more conspicuously and more favourably upon the map than it could have been done by any other means or by the demonstration of any other characteristic of our people.

Notwithstanding the policies which have been adopted in the British Isles and European countries, I feel sure that many thousands will come to Canada to make their homes on Canadian soil, and especially will they come because of the very attractive land policy which Canada is adopting and which, when it is worked out in its full detail, I believe, will be the most generous land policy of all the Allies.

In so far as emigration from the leading enemy countries is concerned, I do not think there will be any disposition on the part of the Canadian people, at least in our generation, to encourage emigration from those countries. For if this war has taught us anything, and it has taught us many things, there is one important thing that it has taught us and that is, that we should be more discriminating in regard to immigration in the future than we have been in the past. It is only in times of trial and distress that we realize the importance of this phase of our national life. We must try to secure a larger proportion of British immigration in the future so that, shoud we have another day of trial, similar to that which has visited our country in the last four years, we may rely upon our population and not have our efforts thwarted by alien enemy races within our borders.

I thank you kindly for your courtesy in extending to me this invitation.

Mr. William Pearce, of Calgary, who was described by the Chairman as "one of the institutions of Western Canada" gave a most interesting address on irrigation development and the construction of automobile roads in the West.

Mr. William Pearce: Mr. Chairman and Gentlemen, the Chairman might have said, and have said with truth, that he was going to introduce a man who could not make a speech, but perhaps he thought that was superfluous because you will find it out very quickly. I desire to compliment the Minister of the Interior, the ex-Minister of the Interior, and the Surveyor-General for the very excellent addresses which they have made. I am going to suggest to the present Minister of the Interior that the address that he made before the Royal Geographical Society some time ago, and which was printed in their journal, should be published in pamphlet form for distribution.

I want to congratulate the Association on the steps they are taking towards the promotion of settlement in the West. When I say the West, I am speaking of the three prairie provinces and of British Columbia. I think we might take it for granted that the problem before us is not how to spread out settlement more but how to make it closer and as compact as possible. The question then arises as to what is the best means of promoting close settlement. There is no doubt what the answer would be. Following the progress of events in every new country adapted to grain-growing, every one makes a quicker profit and more rapid progress in grain-growing than in any other branch of agriculture. But anyone who follows that up can see the ultimate results of such a system of settlement. You will find that the results are most deplorable and that the last stage is worse than the first. Travelling on a train and looking out of the window you can easily distinguish the grain-producing districts from the mixed farming districts. You will find that the dairying districts are the most thickly settled and the most prosperous. If we want to populate our western country and to promote its prosperity, let us try and encourage dairying. For dairying you require water and you must have plenty of it. It has been calculated that beef cattle could not possibly be profitably pastured at a distance of more than two miles from water, in dairying very much less. Such being the case, you naturally want a plentiful supply of water.

I am not going to enlarge upon the importance of irrigation in general, something which everybody realizes and admits, but I am going to confine my remarks on the present occasion to a discussion of supplying water for stock-watering purposes, and the eventual development of irrigation by individual effort under small compact and easily worked out schemes on the lines of the first irrigation from the slopes of the Rocky Mountains in the Western States, where irrigation up to the early eighties, only cost $7 per acre. That was extended and developed on a larger scale and the cost has been run up to from $50 to $80 per acre.

Twenty years ago I urged the then Minister of the Interior to have surveys made to determine whether a scheme was feasible to put an immense amount of Northern Alberta and Saskatchewan under water with a view to ultimate irrigation primarily for stock-watering purposes. All I urge now is that the necessary surveys be made and the information secured to see whether it is financially possible to carry out that scheme. That it is physically possible, there is no doubt, but whether the outlay will be such that we can undertake, is a question that must be ascertained. The area which will be supplied with water is roughly bounded, on the east and south, by the South Saskatchewan River and the Red Deer River and, on the North by the North Saskatchewan River below the mouth of the Battle River and west of that by the Battle River itself. There is in that region an area of 18,000,000 acres of land which I know could be supplied by the waters of the North Saskatchewan, but at what cost remains to be seen. Of that area 12,000,000 acres lie in the Province of Saskatchewan and 6,000,000 in the Province of Alberta. Having been over that territory to a greater or lesser extent, I would estimate that out of that 18,000,000 acres, 70 per cent, would be rendered at once available for stock watering and water for stock would be within a reasonable distance of that percentage of the land.

Out of 18,000,000 acres I should imagine that 30 per cent could be and would be used by individuals taking their supplies from that source for their own purposes and applying their own labour to it. Out of the 18,000,000 acres which would be supplied with water, not over 50 per cent would be useful for dairy stock as distinguished from range stock. Beef cattle will fatten and travel a considerable distance for water, but if you go in for dairying, and you want to get any milk, your cows must not travel over too much territory during the day. Therefore, as I say, I do not think that over 50 per cent of the area would be useful for dairying. Possibly it would not be that much.

The members of your profession, with your knowledge of the topographical features of the territory, and your experience of prairie areas, should be able to determine whether the proposition I have made is feasible or not. I believe it is. There is nothing that I can think of in the whole four provinces that would yield a quicker return than such a policy if given effect to. But I do not know whether it is financially possible. Certain surveys should be made and I think no time should be lost in considering them. I have no doubt that your Association would be able to assist in the working out of the scheme.

I have been trying to have an interview with the Minister of the Interior for the last few days but I have been unable to find him in his office at any time that I was able to get there. It was largely for the purpose of drawing his attention to this matter and, now that I have him here, he cannot get away and I have an opportunity of bringing it to his attention. I may say to those of you who do not know me that I have always been considered a crank on some things and one of those things is water supply and irrigation. I know that the Minister of the Interior has taken a very warm interest in certain similar schemes in Southern Alberta which, I believe, are feasible and which would work out to the great advantage of the districts served.

There is also another feature which, although not directly connected with the prosperity of the country, and that is the laying-out of automobile routes in the mountains with the view of inducing tourist traffic into the country. Every dollar you get from the tourist is a dollar found. I know that we could get enough to pay a very big dividend on the outlay. Switzerland is an example of that. A very large percentage of the revenues of Switzerland has been received from tourists; in fact, Switzerland would be a very poor country if it had not been for the tourists. I would like to direct attention to the fact that perhaps the most beautiful mountain resort in the United States is Glacier Park which has the backing of the Northern Pacific Railway, the Chicago Milwaukee and St.

Paul, and kindred interests. It lies immediately adjacent to the boundary and it would be a very easy matter to lay out automobile routes and bring them as far up as Jasper Park through some of the most magnificent scenery in the world. I do not know any way in which your services could be more usefully employed than in laying out some of these routes. If we have to provide for unemployment, if we have to give employment to returned soldiers, what better work could we put them at than right along that line? In the summer time you could build those portions of the routes which lend themselves to economical building in that season, while in the winter time the men could be provided with huts and their services utilized in clearing and grading the roads especially where rock work is required.

Music was furnished during the luncheon by an Edison Diamond Disc machine kindly loaned by The Phonograph Shop, Sparks street.

The luncheon was concluded with the singing of the National Anthem.

THURSDAY AFTERNOON SESSION.

Mr. J. W. Pierce presented the report of the Dominion Lands Surveys Committee, of which he was chairman, as follows:

Owing to the limited field operations during the past season in connection with the survey of Dominion Lands, our duties were found to be correspondingly light.

There have been, however, a few events of vital interest to the profession, the most important of which is the opening up of an entirely new field of operations with almost unlimited future possibilities. This consists of the classification and valuation of lands,—a subject which is to be fully discussed by Mr. Brenot, this afternoon. Two survey parties were engaged on this work throughout the season, while towards the end, two more parties were added. This has resulted in a complete investigation of upwards of 125 townships at a cost which is very small, when compared with the area examined. We are of the opinion that the importance of this work warrants the attachment of additional assistance to our regular subdivision parties whose duties would be the classification of lands during the process of survey.

The scientific clearing, improvement and reclamation of lands on an extensive scale, is, we believe, an operation of the near future in this country, that will have to be undertaken by a body of technical men and we suggest that Dominion Land Surveyors give these problems due consideration with the object of being prepared.

During the early part of the year, this committee prepared a letter which was sent to the Surveyor-General in connection with the status of Dominion Land Surveyors under changes in the Civil Service Act that were being considered. As there has been some misapprehension in regard to what was covered in these letters, our letter and the Surveyor-General's reply are appended hereto.

LETTER TO SURVEYOR-GENERAL SIGNED BY TWENTY-FIVE SURVEYORS.

Sir,—

A Bill was presented to Parliament a few weeks ago providing for extensive and radical reforms to the Civil Service Act. Although this Bill will no doubt undergo some minor amendments before it becomes law, it seems reasonably certain in view of the policy announced by the Government that the Act as finally passed will substantially embody the proposed reforms.

One of the main features of the new Act will be the extension of the existing provisions of the Civil Service Act and regulations made thereunder to the outside Service. This broad amendment will entail a reclassification of the outside service and change the character of the employment of members of that service so that hereafter their appointment instead of being temporary will be permanent, that is during pleasure.

Although it is not known how the new Act will affect the appointment and status of the Dominion Land Surveyors employed every year by your branch, the undersigned presume that the enactment may and will probably necessitate the appointment of a permanent staff of surveyors whose functions will be to carry on under your direction the work of your Branch. The object of this memorial is not to directly or indirectly suggest to you or to the Departmental authorities the policy which should be followed in connection with the new appointments. We dare say however, and we hope that this will not appear presumptuous on our part that the new staff will be appointed from those who have had experience in your Branch and whose services you have found satisfactory.

Our object is therefore to respectfully submit to you our views in connection with the reorganization of the Branch on the assumption that the appointments will become permanent and particularly in connection with the new method of remunerating your surveyors which of necessity, will have to be adopted. This is a matter of vital importance to those among us who will secure appointments. The fixing of the yearly salary is really the matter of main importance. In determining this salary, we submit that consideration should be given to the character of the work which makes of surveyors technical officers, to the salaries paid in other departments to technical officers and finally to the salaries which surveyors have been receiving in the past.

We will not dwell on the character of the work, which is so well known to you. We wish, however to point out that in other departments the technical officers are well remunerated. The following is a list of some of the Departments and the numbers of technical officers in same securing salaries ranging from $2,100 to $4,000, chiefs of divisions excluded.

Interior Department:—Geodetic Branch, 2 employees drawing $2,800; Timber and Grazing, 1 employee drawing $2,800; Mine Lands Branch, 1 employee drawing $2,050, 2 employees drawing $2,800.

Department of Secretary of State, Mines Branch:—11 chemists, engineers, etc., from $2,100 to $2,600.

Geological Survey:—40 from $2,100 to $3,500.

Department of Agriculture:—40 technical officers drawing from $2,100 to $3,500.

Department of Marine:—25 engineers from $2,100 to $2,900.

Department of Naval Service:—6 engineers from $2,300 to $3,200.

Department Public Works:—27 engineers, architects and inspectors drawing from $2,100 to $2,800.

Justice Department:—4 legal officers from $2,400 to $4,000.

Railways and Canals:—9 from $2,100 to $3,000.

In regard to the salaries drawn by surveyors in the past, we may say that we have ascertained that since 1913 the average salary of surveyors drawing $8.00 a day has been $2,300 for work performed during ten to eleven months of the year, and this is exclusive of the field allowances which are paid under the Manual of Surveys. It may be stated here that our salary has not increased during the last 8 or 9 years although the cost of living has nearly doubled. Under the circumstances, and even taking into consideration that under the new law our salaries will be subject to statutory increases we submit respectfully that the new fixed salaries should range from $2,100 upwards a year to be suplemented of course by a reasonable field allowance when the surveyors are actually engaged in the field.

We realize that, even upon these terms, the surveyor's income will be materially reduced, but we are taking into consideration the permanency of the appointment and also the element of statutory increases. We are taking the liberty of submitting these views to you, Sir, remembering the very fair and impartial treatment which we have received from you in the past, and having full confidence that you will kindly see that your surveyors will receive just and adequate consideration in the proposed reforms.

Surveyor-General's reply, dated July 12, 1918, addressed to the Secretary:—

I have received your letter of June 25 transmitting the petition of a number of surveyors in which they request to be permanently appointed at salaries ranging from $2,100 upwards.

The petition will be laid before the Minister for his consideration.

It may be well, however, to call the attention of the petitioners to the fact that the salary of Dominion Land Surveyors on appointment to the inside staff is $1,300 and goes up by annual increases to $1,600 where it may stay for many years. I have never been able to obtain better terms for them or to secure more rapid promotion. In the face of these conditions in the inside staff, it is scarcely to be expected that the Government will consider the appointment of Dominion Land Surveyors to the outside staff at $2,100 with annual increases to $2,800.

At nine dollars per day, a surveyor on the outside staff will average for ten months' work $2,700. As long as he is in the field, he is practically under no expense except for wearing apparel, and he should be able in a few years to lay a comfortable sum aside. It seems to me that there are few professions where a young man can, a short time after graduating from the university, secure a position with an equivalent remuneration. Of course $2,700 is not a very large sum in war time, but it is a very substantial income in normal times which are bound to come back some day. It seems to me that surveyors would be ill advised to exchange their present mode of remuneration and employment for permanent appointments which, so far as can be foreseen, would not be on more favourable terms than those ruling in the inside service.

Mr. E. M. Dennis, D.L.S., presented a paper enumerating the honours won and sacrifices made by Dominion Land Surveyors in the great war.

WAR HONOURS WON BY DOMINION LAND SURVEYORS.

Compiled by E. M. Dennis.

In presenting this list of war honours won by Dominion Land Surveyors, it should be stated that this must not be considered a complete list. The information was jotted down from time to time as it was observed in the Canada Gazette and in a few cases from newspaper reports. It is difficult to be certain of persons mentioned where only the person's initials are given as is the case usually with privates and non-commissioned officers so that this part of the list is almost certain to be incomplete. It is also incomplete with respect to those who enlisted in or were transferred to the Imperial Army. If any names have been omitted the Secretary will be pleased to hear of the same with a view to making the record complete. The returns are given as far as possible in chronological order.

19th August, 1916—Military Cross—Capt. George Zouch Pinder, Canadian Infantry.

For conspicuous gallantry and ability when leading his company in a counter attack, and in subsequently controlling his men when severely wounded.

25th August, 1916—Military Cross—Lt. James Joseph Stock.

For conspicuous gallantry during operations. He carried out the preparations for three assaults with great judgment under heavy fire. On one occasion he was hit on the chest by a bomb which failed to explode, but he carried on with great coolness.

14th November, 1916—Military Cross—Second Lieutenant John Robertson Graham, Royal Artillery, Special Reserve.

For conspicuous gallantry in action. When observation officer he was buried by a shell, and under intense fire he continued to carry out his work with great courage and determination.

14th November, 1916—Distinguished Service Order—Major George Walkers MacLeod, Canadian Infantry.

For conspicuous gallantry during operations. He went forward into the fight and selected the ground to be consolidated and, though severely wounded, made his way back under heavy fire and rendered a complete report on the situation. He has always set a fine example of coolness and courage.

14th November, 1916—Distinguished Service Order—Major Harold French McDonald, Canadian Infantry.

For conspicuous gallantry during operations. He carried out a dangerous reconnaisance under heavy shell fire and after a shell splinter had blown off his arm he reported the result of his reconnaisance before allowing the stretcher bearers to remove him.

23rd December, 1916—Military Cross—Lt. Angus Urquhart Meikle, Canadian Artillery.

For conspicuous gallantry in action. He handled his gun with great courage and skill under the most trying circumstances and heavy shell fire.

1st January, 1917—Distinguished Service Order—Major Johnson Lindsay Rowlett Parsons, Canadian Infantry.

1st January, 1917—Military Cross—Capt. Francis Alfred Wilkin, Motor Machine Gun Brigade.

1st January, 1917—Military Cross—Lt. Roger Fyfe Clarke, Canadian Tunnellers.

2nd. January, 1917—Mentioned in Sir Douglas Haig's despatches of 13th November, 1916:

Major J. L. R. Parsons, Canadian Infantry.
Major H. F. McDonald, Canadian Infantry.
Major G. W. MacLeod, Canadian Infantry.
Major W. L. Malcolm, Canadian Engineers.
Lt. Frederick Alport, Canadian Engineers.
Lt. F. J. Dawson, Canadian Engineers.

15th May, 1917—Mentioned in Sir Douglas Haig's despatches of 9th April, 1917.

Lt. P. J. Moran, Canadian Engineers.
Capt. Douglas S. Ellis, Canadian Engineers.
Capt. (Acting Major) H. W. Tate, Canadian Infantry.

1st June, 1917—C.M.G.—Lt.-Col. H. F. McDonald, D.S.O.

27th July, 1917—Name brought to the notice of the Secretary of State for War for distinguished services in connection with the war.

Lt.-Col. H. F. McDonald, C.M.G., D.S.O.

16th October, 1917—Military Cross—Lt. Hugh Edward Pearson, Canadian Infantry.

For conspicuous gallantry and devotion to duty. When his company commander was wounded, he led the company to their objective with the greatest ability, afterwards organizing and supervising the moppers up for the attack upon the next objective. On the following day although wounded in three places and badly bruised by a rifle grenade, he continued to command his company, supervising every detail of attack and consolidation with a pluck and cheeriness that greatly inspired all his men.

25th December, 1917—Mentioned in Sir Douglas Haig's despatches:
Lt. H. E. Beresford, Royal Engineers.

1st January, 1918—Distinguished Service Order—Lt.-Col. Frederick Fieldhouse Clarke, Railway Troops.

Military Cross—Lt. Ormond Montgomery Stitt, Canadian Engineers.

Mentioned in Sir Douglas Haig's despatches of 7th November, 1917:

Lt.-Col. F. F. Clarke, Railway Troops.

Lt.-Col. A. C. Garner, Infantry.

Lt. A. R. Neelands, Canadian Engineers.

14th January, 1918—Authority granted to wear the insignia of the Russian Order of Ste. Anne, second class (with swords).

Lt.-Col. H. F. McDonald, C.M.G., D.S.O.

15th January, 1918—Bar to D.S.O.—Major George W. MacLeod.

For conspicuous gallantry and devotion to duty. He displayed the greatest initiative in supervising the assault and accurately reporting the position of the attacking troops. He was untiring in his efforts to strengthen the captured position and contributed largely to the success of the operations. He set a splendid example of coolness and courage.

1st. February, 1918—Military Cross—Lt. George Hendry Ferguson, Canadian Engineers.

For conspicuous gallantry and devotion to duty. He constructed a duck board track in preparation for an attack, though his party was heavily shelled and several times driven off the work. He reassembled them each time and completed eight hundred yards of track.

1st February, 1918—Military Medal—Sapper (Acting Sergeant) W. A. Scott, Canadian Railway Troops.

3rd June, 1918—Distinguished Service Order—Major Douglas Stewart Ellis, Canadian Engineers.

Military Cross—Lt. Abram Rupert Neelands, Canadian Engineers.
Mentioned in Sir Douglas Haig's despatches of April 7th, 1918.
Lt.-Col. J. L. R. Parsons, D.S.O.
Major G. W. MacLeod, D.S.O.
Major D. S. Ellis.

23rd. July, 1918—Bar to D.S.O.—Lt.-Col. Frederick F. Clarke, Railway Troops.

For conspicuous gallantry and devotion to duty during a hostile attack lasting for four days. He organized from his battalion sixteen Lewis gun teams and made all arrangements for ammunition and supplies to be brought up to the front line by his own lorries. Except for the higher direction of the defense, the unit was entirely self-contained. The promptitude and alacrity with which this unit responded for volunteers, the splendid manner in which the defense was organized, the coolness and sustained enthusiasm displayed were due to the courage, inspiring example and fine leadership of the commanding officer.

3rd September, 1918—C.M.G.—Col. John Stoughton Dennis, British Canadian Recruiting Mission.

7th October, 1918—Name brought to the attention of the Secretary of State for War for valuable services rendered in connection with the war.

Col. J. S. Dennis, C.M.G.

10th October, 1918—Permission granted to wear the Croix de Guerre bestowed by France.

Lt.-Col. J. L. R. Parsons, D.S.O.

1st January, 1919—C.M.G.—Lt.-Col. J. L. R. Parsons, D.S.O.
Distinguished Service Order—Lt.-Col. Albert C. Garner.
M.B.E.—Lt. H. E. Beresford, Royal Engineers.

Mentioned in Sir Douglas Haig's despatches of Nov. 8th, 1918—Lt.-Col. J. L. R. Parsons, D.S.O.
Lt.-Col. A. C. Garner.
Lt.-Col. F. F. Clarke, D.S.O.

11th January, 1919—Military Cross—Capt. George Hugh McCallum, 4th Battalion, Canadian Engineers.

*Feb. 1st, 1919—Military Cross—Capt. Hobart Rodney Carscallen, 11th Battalion Engineers.

On the Hendecourt-Dury Road, on October 2nd, the road on which he was engaged on repair work, was the target of many of the enemy guns of large calibre. His company commander was wounded and he exposed himself in giving immediate assistance and rendering first aid. He then took command of the company and until seriously wounded directed and encouraged his men to complete this essential task.

February 1st, 1919—Military Cross—Lt. Henry Belfrage Miller, 11th Battalion Engineers.

On September 3rd, when engaged in a reconnaissance of water supply in the captured area east of the Drocourt-Queant line, he with a party of six men proceeded through Dury to Ricourt and Ecourt St. Quentin. In these two villages they located twelve wells which had been repaired by the enemy. They repaired these and put up signboards. During this reconnaissance the enemy shelled the villages very heavily and two of the party were wounded.

February 1st, 1919—Military Cross—Lt. Francis P. Steers, 2nd Battalion Engineers.

For great gallantry and devotion to duty during attack on the Queant-Drocourt line east of Arras. More especially on the night of February 1st, when in charge of 100 sappers, called out for work in con-

*Additional information added after the annual meeting.

solidating the front line. Though warned that a counter attack was imminent, he delivered shovels to the infantry in the front line under trying conditions. The following day he led his men through with the infantry and worked all day under heavy shell fire on the roads enabling ambulances and guns to go forward.

8th March, 1919—Bar to Military Cross—Major George Hugh McCallum, 4th Battalion, Canadian Engineers.

2nd April, 1919—Military Cross—Capt. William Campbell Murdie, 9th Battalion, Canadian Engineers.

Military Cross—Capt. Frederick Alport, Canadian Engineers.

Military Medal—Lt. M. D. McCloskey, Survey Section, Field Artillery.

MR. MCARTHUR: Are those whose names have been mentioned all members of the Association?

MR. DENNIS: No, they are Dominion Land Surveyors, not necessarily members of the Association.

MR. KING: Lieut. Clarke is here and if he is able to overcome his well-known modesty he might tell us something about his experiences at the front.

LIEUT. CLARKE: Mr. Chairman and Gentlemen, it is extremely difficult to enable anyone who has not been there to visualize the conditions under which modern war is carried on, and furthermore I feel rather diffident about attempting it, because no doubt many other Dominion Land Surveyors, members of this Association, are better qualified than I am. I may say, however, that I enlisted with the unit that went from Queen's University—the 6th Field Company of Engineers. I enlisted in November, 1914. We went overseas in April, 1915, and arrived at Havre, France, on the 17th September, 1915. There were a number of other Dominion Land Surveyors in the Unit. We had the pleasure of being here for the Association meting in February, 1915. Mr. W. S. Earle, who was a great friend of mine, and who got promotion in England just before we sailed for France, joined the Flying Corps, went over to France and was killed very shortly after he got there. He was killed at Peronne and is buried there. I remained with the unit for about nine months in France when I was successful in getting a commission with the 3rd Tunnelling Company. I do not know that there was any other Dominion Land Surveyor at that time in the 3rd Tunnelling Company, although Lieut. Orville Rolfson since joined it. He has been in France for nearly a year. I stayed with the Company for fifteen months until I was wounded.

Lieut. Clarke continuing, gave a most interesting and graphic description of the methods employed by the tunnelling company, and declared this to be one of the most interesting phases of engineering work in connection with the war. He went into considerable detail, outlining the construction and purpose of the listening galleries, the methods of guarding against underground enemy attack and the operation of the electrical apparatus, notably the geophone, for detecting subterranean sounds.

MR. BARBER: Mr. Chairman and Gentlemen, I would like to take advantage of this opportunity to move: that this Association extends its sympathy to the relatives and friends of those Dominion Land Surveyors who have given their lives in the service of the Empire during the great world war which has fortunately now ended. Some of those relatives are with us at this meeting. Thirteen Dominion Land Surveyors made the supreme sacrifice, as follows:

Lieut. B. C. Pierce	Lieut.-Col. H. J. Bowman
Pioneer L. E. S. Bolton	Lieut. J. R. Graham
Lieut. W. M. Carthew	Lieut. W. S. Earle
Lieut. H. S. Holcroft	Lieut. E. M. Dann
Capt. D. D. MacLeod	Lieut. L. H. Gass
Lieut. A. J. Latornell	Lieut. M. L. Gordon

Capt. O. M. Stitt

Capt. J. J. Stock was badly wounded.

Last year there were two members of our Association in the deceased list, Capt. J. E. Roy and Prof. W. M. Edwards. Of these men who have sacrificed so much we are justly proud. We honour their memory. May their example prove a stimulus to us to serve with greater diligence in the time that is to come.

MR. ENGLER: I beg to second that resolution.

Motion agreed to.

The resolution was acknowledged by Mr. G. P. Roy and Mr. J. W. Pierce.

MR. AKINS: Do you intend that the Secretary shall write to each of these relatives and convey this sympathetic greeting?

MR. BARBER: I did not mention that in my motion but I would like my motion to include that.

MR. HENDERSON: While we are on this subject of the war I think it would be interesting to the meeting to hear something of the war that took place in our own country about thirty years ago, known as the North-west Rebellion. Mr. J. N. Wallace wrote me a letter in September and enclosed the following list:

NORTH WEST FIELD FORCE—REBELLION OF YEAR 1885.

Members of Dominion Land Surveyors Intelligence Corps.

Captain—J. S. Dennis.

Lieutenants—J. J. Burrows, W. Small, A. O. Wheeler, G. H. Brabazon, L. R. Ord, J. F. Garden, W. Beatty, B. J. Saunders, J. K. McLean, C. E. Wolff, H. C. Denny, J. A. Maddock, J. McLatchie, W. Crawford, T. S. Gore, A. W. Kippen, T. Fawcett.

Acting Assist. Surgeon—C. S. Haultain.

Privates—L. Blanchet, R. C. Woodley, W. E. DeRinzey, J. F. Mowat, F. W. Cumming, J. P. A. Sproule, A. Fawcett, J. A. Milne, W.

B. Cornock, H. D. Kelly, W. B. Ord, F. A. Martin, A. Stephen, C. Campbell, H. J. Dennis, J. Johnson, W. F. Torrance, T. S. Russell, A. E. Driscoll, B. Anderson, A. Hawes, M. Morrison, J. Hunt, C. Popham, J. M. McVicker, W. Challoner, G. W. Campbell, F. A. Disbrow, G. L. Garden, T. Henderson, F. Bourgeau, A. R. Burns, W. A. Giles, C. B. Perry, F. Shea.

From "Reminiscences of the North West Rebellion" by Major Charles Arkall Boulton. Commanding Boulton's Mounted Scouts. Published Year 1886.

Mr. McArthur: Regarding the Rebellion of 1885, Mr. L. R. Ord, a year or two after the Rebellion, published a little pamphlet entitled "The Tale of a Bungle" by one of the Bunglers. It was very good-natured and very amusing.

Mr. R. W. Cautley, D.L.S., was down on the programme to read a paper on Assessment Surveys of Farm Lands, but Mr. Cautley not being present, the paper was read by the Secretary.

ASSESSMENT SURVEYS OF FARM LANDS.

R. W. Cautley, D.L.S.

In the very near future it will be necessary for the Governments of the western provinces of Canada to change their entire system of assessment of farm lands for taxing purposes from a flat rate of so many cents per acre to the more equitable basis of assessment in accordance with the relative value of the land and buildings.

So far, the rate of taxation on farm lands has been so extremely low in Western Canada that it has been found possible to collect the necessary taxes on a flat rate basis without the injustice of the system becoming too obvious. That the flat rate system is unjust, however, and contrary to all modern tendencies of constitutional taxation, is apparent at once on investigation. For instance, suppose A to be the owner of 640 acres of land valued at $50 per acre, with buildings valued at $12,800, bringing the actual total value of the land up to $70 per acre; and suppose B to be the owner of a homesteaded quarter section, fifteen miles from a railway, valued at $7 per acre, with log buildings valued at $320, bringing the actual value of the land up to $9 per acre. Then suppose that the total taxation in each case amounts to 20 cents per acre. It follows that the rich farmer A pays a tax amounting to nearly three mills on the dollar while the poor farmer B pays 22 mills on the dollar—i.e. B pays rather more than seven times as much as A on an ad valorem assessment basis.

After all, B is not paying any more taxation than he should be paying, since 22 mills on the dollar is not a very serious tax when it is considered that almost all of the money so collected is actually spent for the direct benefit of himself, either for local schools or roads. In this connection it may be pointed out that property owners in cities are paying from 25 to 35 mills on the dollar on an assessment that is so absurdly high that the tax rate really amounts to from 50 to 70 mills on the dollar.

The difficulty is that A, who is a wealthy member of the community, is not paying toward the revenue of the State in proportion to his ability, with the result that much of the development work that has been carried on by the Government has had to be financed with money borrowed against the general credit of the province instead of from current revenue.

Having established the fact that the flat rate system of taxation is inequitable in its operation, let us consider the objections to the ad valorem system, and the reasons why the western provincial governments have not adopted it so far.

In the first place the ad valorem assessment system places the onus on the Government of establishing the value of the land to be assessed; it means that a large force of inspectors have to be kept in the field and that the cost of collection is greater than under the flat rate system, where all that it is necessary to establish is the fact of ownership as registered in the Land Titles Offices. Moreover the cost of inspection is much higher for the slightly developed districts than for those which are more fully developed relatively to the amount of taxes to be derived from the two districts; to put it another way—while the cost of inspection of an undeveloped district would be less per township than for a fully developed one, the amount of taxation to be derived from the fully developed township would more than compensate for the higher cost of inspecting it.

In the second place it is not possible to put in operation a system of taxation based on an ad valorem assessment until the information gained by the inspectors in the field has been converted into a convenient form of office record so as to be available for the use of the Assessor and his staff.

It would, therefore, not be possible to put such a system in force at all without a careful preparation extending over two years at least, unless some very haphazard method of arriving at an assessment of value were adopted—such as compelling all owners to make an affidavit of value and accepting such affidavits as being prima facie correct, or employing the secretary-treasurers of municipalities to make reports in their own districts. It may be found necessary to adopt some such expedient as the above in order to get the system started, but such expedients should, in any case, only be regarded as temporary expedients and not as a permanent basis of assessment.

Every Trust and Mortgage Company knows how essential it is to employ trained men for land inspection, and how generally incorrect the reports of farmers or their neighbours are in respect to properties which they themselves know well. When these reports were known to be for the purpose of assessment for taxes it is quite certain that many of them would be more than usually misleading.

Whatever the merits of the flat rate system for a new and sparsely settled country with an extremely low rate of taxation, there would seem to be very little doubt that it will be impossible to maintain it under the changing conditions with which the Governments of western provinces are faced today.

On the one hand it is very difficult—even for a Government—to borrow money at all, so that the policy of borrowing against the future to supply the needs of the present in order to carry on provincial undertakings is no longer practicable even if it were desirable.

On the other hand provincial governments are faced with the necessity of raising more money than ever before. This fact may be attributed to three causes:—

First, the farmers of the western provinces have grown very prosperous in the past three years, and are impatiently clamouring for more speed on the part of their governments in the development of the agricultural districts. The extension of rural telephones, the construction of roads and bridges, schools, hospitals, experimental farms and agricultural colleges all cost money; various forms of social legislation have been placed on the statute books, for the administration of which the governments have to find the money, so that the amounts required by the governments for what may be called normal expenditure have increased very largely;

Secondly, it has been found necessary to create special taxes for patriotic and war purposes.

Third, the diminished purchasing power of the dollar. This last is an accomplished fact which many of us have refused to recognize as such, but, whether it is the salary of a school teacher or the cost of a steel bridge the price has gone up and, after all, it is the same grade of school teacher and the same weight of steel; it is only the price which has changed.

From all of which the outstanding fact, as it affects our subject, is that the amount of money to be raised by taxation has already increased very largely, and is still increasing, with the result that the annual tax rate per acre under the flat rate system of taxation is no longer a particularly low one.

Under these circumstances the weakness of the flat rate system—namely its inherent injustice—becomes exaggerated, while the undesirable feature of the ad valorem assessment system—namely its greater cost of administration—becomes less important and better justified as the amount of taxation to be raised becomes greater.

That the Provincial Governments affected have this matter under their careful consideration, and recognize the impending necessity of making a change, is well known; in fact the idea for this Paper was furnished by the Honourable Charles Stewart, Premier of Alberta, in an address to the Anglican Club at Edmonton, delivered on the 18th April, 1918, in which the Premier discussed the subject of taxation, fully admitting the inequalities of taxation which were unavoidable under the flat rate system and looking forward to the inevitable establishment of an ad valorem assesment as the basis of future taxation. The Premier, however, did not seem to be contemplating the assessments of improvements to land, but of the land alone.

In the second part of this Paper it is proposed to discuss the best methods of securing the departmental information necessary before any system of ad valorem assessment can be put into effect.

It is hoped that this subject may prove of practical interest to members of the Association, because the greater part of the work involves knowledge of field surveying, mapping, obtaining information from Registry Offices and maps of former surveys and valuation—all of it work for which a land surveyor is specially adapted both by training and experience. In this connection it will have to be borne in mind, however, that the surveys to be made will not affect titles to land, so that they will not necessarily come under the head of surveys as defined by the various survey Acts Dominion or Provincial: this means that it will not be obligatory on the Government to employ commissioned land surveyors as field inspectors, unless it is specially provided in the Act that only comissioned men shall be employed. There appear to be good reasons for making such a provision:—one is that it is work of great importance which is destined to become a permanent branch of the country's administration, and that ought only to be put in the hands of men with a certain standard of character and qualification; another is that commissioned surveyors form a large body of professionl men which has been examined, commissioned and organized by he Government itself. The development of Canada owes much to the labours of the various survey departments of the Dominion, from the heads of the departments down to the thousands of survey men who have suffered and endured, and who showed what kind of stuff was in them by enlisting almost as a unit as soon as war broke out. With such an organization of highly qualified men available for this new development of their own special work, it would seem to be a mistake to create a new body of land inspectors, who would have to be carefully trained in any case.

The questions that come up for consideration in connection with an assessment survey may be dealt with under the following headings, of which (d) and (e) have been estimated for the Province of Alberta, as an example.

(a) General outline of suggested scheme.
(b) Nature of field inspection, or survey.
(c) Most convenient form of office record.
(d) Probable time required to put system in operation.
(e) Probable cost per acre of completed work.

GENERAL OUTLINE OF SUGGESTED SCHEME.

Roughly speaking, it may be assumed that the part of the Province of Alberta more or less occupied at this date as farming land extends from the International Boundary northward to Township 60, and from the Fourth Meridian westward to Range 8 west Fifth Meridian, comprising 2,100 townships; it will be understood that the above is merely an approximate generalization for the purpose of this paper and is by no means accurate although close enough for the present.

Of these 2,100 townships certainly not more than 900 are within reasonable distance of railways or can be said to be farmed land in any true sense of the word.

It is suggested that the remaining 1,200 townships together with all townships taken up and settled in future shall still be taxed on a flat rate system until such time as the Government is of opinion that the stage of development in any township is such as to justify having an assessment survey made.

To make an assessment survey of a township in which development was represented by scattered homesteader's improvements would not pay; in the first place, the survey would cost nearly as much as that of a fully developed township—perhaps quite as much when the cost of getting to it was taken into account—and the revenue to be derived from taxation would often be only ten per cent of that to be derived from a fully developed township; in the second place, development proceeds so quickly in a newly settled township that the information gained would not be up to date even by the time the resulting map of the township was printed.

The problem for immediate consideration, therefore, resolves itself into making an assessment survey of 900 townships.

It would probably be found necessary to create a sub department of the Government to organize and take care of this work, because it is new work for which there is no present provision in any of the departments of the Government.

It must also be recognized that the work of this sub department will be permanent and continuous, first, because in each succeeding year new townships will reach that point of development where it is necessary to make an assessment survey of them, and, secondly, because there is not perhaps in the whole Province of Alberta one single township that is cultivated to its fullest extent, so that it will be necessary to make a resurvey of improvements every ten years or so.

NATURE OF FIELD INSPECTION, OR SURVEY.

The object of the inspection is to arrive at a fair value of the land and buildings, and the obtaining of all necessary information to that end.

It would not be necessary to make an instrument or chain survey; this would add immensely to the cost of the survey, and require field assistants. All measurements could be made with sufficient accuracy by the inspector himself, using a prismatic compass for angular measurement and a pedometer for measuring distances.

Each inspector would require one man to cook, make camp, conduct minor inspections. He would also require a light car, or democrat according to the character of the roads in the district to be surveyed.

Inspectors should be furnished with note books containing 36 pages, each page representing one section of a township.

All the men employed as inspectors should be capable of mapping their own work during the five winter months in which snow and frost make field inspection unreliable, so that it is absolutely essential that his field-notes should contain clear and full information which is entirely independent of memory.

The notes should show the following information for each quarter section:—

(1) Amount, location and class of all cultivated land.

(2) Amount, location, class and description of all unbroken land which is of a character to be brought under cultivation.

(3) Amount, location, class and description of all waste land, such as wet marshy land, steep rough banks or land so badly broken up as to be useless for any other purpose than pasturage.

(4) Description, valuation and approximate location of all farm buildings, or of school, church or store buildings.

(5) Description of source of water supply.

(6) Class of roads adjoining quarter section.

Land classification should be based on the class of soil and should also take into consideration the nature of the surface; for instance, in the case of two adjoining farms with identically similar soil, of which one had an evenly undulating surface suitable for economical working with all kinds of machinery, and the other was steeply rolling or broken up by shallow ravines so as to make the working of the land expensive, it would be correct to classify the first farm in a higher class than the second.

It is most important that all inspectors should have similar ideas on soil classification, which, after all, will be the principal factor in assessment of value, and the chief inspector would have to do all in his power to see that the work of all inspectors was kept as uniform as possible.

It is not necessary or desirable that the field inspectors should place any value on the land; the value of the land, according to its class and condition, is largely a matter of its environment, its distance from a railway or the general state of development of the district as a whole, so that the value per acre of the land in any given locality can be better determined by an official of the Department with all the information before him.

The exact location of railways, rivers and lakes can be obtained from the plans and field-notes of existing land surveys more nearly than by any measurements which the inspector might make, but their position should be sketched in the field books.

OFFICE RECORDS OF ASSESSMENT SURVEYS.

In determining the nature of the records to be made of the information gained by field inspectors, there are only three points which it is necessary to take into consideration, namely, clearness of essential details, convenience for purposes of reference and cheapness.

The map which accompanies this paper will give an idea of one way in which it is thought these purposes may be attained.

The idea would be to keep these maps in loose leaf binders, one binder for each range, and the maps in each binder arranged in their order northerly from the International Boundary.

The map and the tabulated information alongside it would constitute the final and complete record of the information gained by the field inspectors. The field books would be kept until the next inspection was made, but would not be referred to by the Assessor and would only be used in the event of some apparent error in the map.

Once the base value of land in any township was established for any given year, the Assessor would be able to compute the exact amount of taxes to which any quarter section in that township was subject from the tabulated data, quickly, easily and with certainty.

PROBABLE TIME REQUIRED TO PUT SYSTEM IN OPERATION.

Assuming the number of townships to be inspected in the first zone of territory to be brought under the Ad Valorem Assessment Act to be 900, the time in which the necessary field and office work can be done varies from one year up in accordance with the number of men employed. If it is assumed that the Government desires to have the work completed in two years it means that 450 townships will have to be inspected in each year.

It may be estimated that a fully developed township in a thickly settled district of the northern part of Alberta, which is for the most part timbered country, will occupy one month of an inspector's time. One the other hand an inspector would probably survey two townships in the more open parts of the Province, where cultivated land is apt to be more regular in shape and easier to survey. It will probably be found that an inspector will be able to survey ten townships in a seven month's season, or that 45 inspectors would have to be employed to survey 450 townships in a year.

Since it is probable that not more than 25 inspectors will be required for the permanent field staff of the Department, and also because it will take time to co-ordinate the work of the Department and to train all the inspectors so that their work may be both uniform and reliable, it would seem inadvisable to attempt to put 45 inspectors in the field, and the necessity may be avoided in any one of three ways:—

(a) By deferring the time of operation of the Act.

(b) By restricting the first zone of territory to be brought under the Act to a smaller number of townships.

(c) By providing in the Act for making the first ad valorem assessment roll on some secondary form of evidence, pending the completion of the surveys.

PROBABLE COST PER ACRE OF COMPLETED ASSESSMENT SURVEY.

An estimate of the cost per acre of an assessment survey may be made on the basis of taking 10 townships as a year's work for each inspector, and finding out the probable cost to the Government of each inspector employed.

The following figures are suggested as the probable cost of the completed work incidental to each inspector employed:—

To annual salary of inspector	\$2,400.00
" field allowances of inspector for 7 mos. @ \$3 per day	630.00
" wages of man for 7 months at \$60 per month	420.00
" field allowance to inspector for man @ \$2 per day	420.00
" transportation @ 15c per mile—say 2,500 miles	375.00
" proportion of rent, material and supervision	250.00
" cost of printing ten maps	350.00
	\$4,845.00

Cost per acre in cents equals $\frac{484500}{230400}$ which equals 2.1 cents.

The above figures mean that in the case of land worth \$50 per acre the cost of making an assessment survey would be about 1/25th of 1% of the value of the land, while in the case of land worth \$10 per acre the cost of the survey would be about 1/5th of 1% of the value of the land.

Under existing conditions Municipal Councils merely assess every acre of land within their municipality for its proportionate share of whatever amount it is necessary to raise.

When taxation is based upon ad valorem assessment it will still be possible for Municipal Councils to collect their own taxes, but the Government will have to furnish them with the assessment roll.

There is one general purpose that will be served by the making of assessment maps, apart altogether from the question of taxation, and that is the usefulness of the maps themselves.

So far practically all the maps of Alberta which it is possible to obtain have been drawn on a very small scale which does not admit of any local information being shown. Edition has followed edition, but the general scheme of all the editions has been the same and none of them has satisfied the growing need of particularized information in regard to settled districts.

If the Government sees fit to undertake the making of assessment surveys and assessment maps it will be found that there is a strong, though limited, demand for better maps from every Trust and Loan Company, from every class of business closely allied with the farming industry—such as implement, grocery and hardware business—and from the farmers themselves.

This phase of the subject, and the consideration of who should make assessment surveys, suggests the far greater one of how best to consolidate and make use of all survey data obtained by Canadian surveyors, in whatever employ, with a view to correcting and amplifying the surveys of Canada, so that none of the work done may be lost, that it may be rendered available for the use of the public in the best form and at the least cost and that there may be as little overlapping of effort as possible.

Survey reduction and map making, in all its various branches, require a carefully built up organization with an expensive plant and—most of all—a trained staff of experts who cannot be got together in a moment. Such a staff and plant is only possible when there is enough work constantly in hand to justify its maintenance cost.

It is my conviction that the survey interests of Manitoba, Saskatchewan, Alberta and the North West Territories would be best served by:—

(1) Uniformity of laws affecting surveys.

(2) One form of commissioned surveyor employed as a permanent civil servant.

(3) One surveyor-general and one office organization.

(4) All surveys to be made by instruction of the Surveyor-General and paid for direct through his department; thus, provincial surveys would be paid for by the province at whose instance they were made; railway land surveys by the corporation concerned and private surveys by the individual.

All the lessons of the war, both on the battle-field and in the organization of industrial production, point conclusively to central control, and if the Association of Dominion Land Surveyors can help to secure recognition of this great principle in Canadian survey matters it will have perfomerd a notable service.

Mr. McArthur: Would the Government be reimbursed for this assessment survey in any way by the municipalities who profit by it?

Mr. Henderson: I do not think he touches on that point. As I read it, the whole cost would be borne by the Provincial Governments.

Mr. Barber: I am not clear as to when these assessment surveys would be made and by whom. Will it be by the Dominion Government? I presume it would be for Dominion Lands. Does he make the assessment at the time the land is surveyed in the case of new land?

MR. MCARTHUR: At the time the municipalities were divided.

MR. HENDERSON: He takes the Province of Alberta and says that not more than 900 townships can be looked upon as settled, and bases his case on this. He suggests that the remaining 1,200 townships shall still be taxed on a flat rate system until development justifies an assessment survey.

MR. BARBER: In the case of the townships that are not yet subdivided, do I understand that he assumes that the assessment surveys can be made at the same time as the townships that are subdivided and that it would not be necessary to make a second survey?

MR. HENDERSON: I am not sure about that.

MR. BARBER: It seems to me that there should be more co-ordination and co-operation and efficiency and less duplication. I understand from the paper that Mr. Cautley does not believe in the system of assessing according to the area but rather according to the value. There is just one point I take exception to. He says that the assessment should be based on the ability to pay. I disagree with that. It should be according to the value received and the service rendered. However, that may be, we agree on one point, that the assessment should be on the value and not on the area. The value of the land should be determined by two things, as I take it, first, its site value, and second, its natural productive value. Its site value would differ from time to time as settlement developed and that could be determined without a surveyor going on the ground at all. That would depend on its nearness to the settlement or the development of the community, and just as settlement progressed, just as roads were built and services were added and just as settlement grew nearer to a particular point, would the site value increase. That could be determined by the officials at the head office here if they had the facts before them. The factor that would have to be determined by surveyors would be the natural productive value. I take it that the value could be determined just as well at the time of the original survey as later because that would not alter. If the settler improves his land by fertilizing or otherwise he should not be taxed for that. That is an improvement just as much as building a house or a barn. He should not be asesssed on that but merely on its natural productive value and that can be determined just as well at the time of the original survey as later.

MR. MCARTHUR: Does he propose that the single tax shall be imposed? Are the improvements on the farm assessed as well as the land?

MR. HENDERSON: It is unfortunate that Mr. Cautley is not here to explain his views. He draws a contrast between land with improvements worth \$70 and acre and land without improvements worth \$7, or \$9 per acre

MR. RANNIE: I imagine he fixes the value on buildings, land and everything and in that way arrives at the taxable amount

MR. SHAVER: I think the method of raising taxes according to Mr. Cautley's idea is to place a premium on idleness. You find there two farmers side by side one with a $9 per acre farm and the other with a $70 per acre farm, the difference being due to the improvements which the latter has made. Yet, because that man has used his energies and his brain and devoted a large part of his life to getting his farm in that condition, he is taxed. I think it is a mistake. I think the rate should be imposed according to the productiveness of the land irrespective of the improvements on it. If you did that you would have more improved land and a better class of buildings upon it. It is not much encouragement for a person to keep his place in good condition if you are going to raise the taxes immediately he makes any improvement.

MR. RANNIE: This is a big question and there is much to be said on both sides. I am no authority on land taxation, but what the last speaker has said reminds me of the practice of doctors and lawyers in charging a man for their services according to what he is able to pay.

MR. MCARTHUR: Why should the expense of making this assessment survey be borne by the Dominion Government and not by the Provincial Governments? It is not responsible for it. The municipalities are within the provinces.

MR. AKINS: It would depend on who would get the returns of anything that would come from that assessment—the Provincial or Dominion Government.

MR. MCARTHUR: The local municipality gets the benefit of it.

MR. CURRIE: I gather that the purpose of Mr. Cautley in writing this paper is to make a place for surveyors in connection with the work. That is his object in suggesting that the control would be under one head. I think he has very cleverly saved himself by specifying that, while any person can be employed as a provincial assessor, he must have the technical qualifications of a Dominion Land Surveyor.

MR. WRIGHT: In looking over the maps that have been passed around, I see that the ordnance maps in England show the buildings and the topographical features. It would not require a great addition to the personnel of the party to place a valuation on those buildings. The production of similar maps in Canada will afford new scope for surveyors because I think such maps would serve a very useful purpose. Land surveyors in the western part of the Dominion are most particularly interested in this matter.

MR. ENGLER: He speaks of a Surveyor-General. In listening to the paper, I came to the conclusion that he referred not to our own Surveyor-General but to a Surveyor-General who would control the surveys in the four western provinces. Do you think that is the right meaning, or does he refer to our own Surveyor-General?

MR. HENDERSON: You will note that he says:

"It is my conviction that the survey interests of Manitoba, Saskatchewan, Alberta and the North West Territories, would be best served by;

"2. One form of commissioned surveyor employed as a permanent civil servant.

"3. One Surveyor-General and one office organization."

MR. ENGLER: Does he mean one Surveyor-General for the four provinces, or the Surveyor-General as we have him now?

MR. BARBER: Whatever he actually may have meant, it seems to me that it would be very inefficient to have a Dominion Land Surveyor go in later, make a survey of the same township, and get practically the same information. If a Dominion Land Surveyor does survey a township and part of that information is turned over to the province, it might easily be arranged that the province should pay a part of the cost to the Dominion.

MR NASH: The municipal lands in the western provinces are the lands that were surveyed some years ago, but these surveys did not obtain the information that this survey is designed to obtain. Mr. Cautley's proposal is confined at present, to the 900 townships that have been surveyed and are now settled. The keynote of the whole paper is the want of a properly co-ordinated system of surveys which, I think, has been characteristic of our surveys so far. That is one of the big questions we have to deal with. We should have a properly co-ordinated survey taking into consideration not only the matter of assessment but all other matters appertaining to the development and welfare of our country. This is a very large question, it will have to be worked out gradually, it will take years to get a new system in operation, and time must elapse before results are obtained. But, at the present time, we have this taxation problem with us. The problem is immediate and must be coped with. We are confronted with the necessity of getting more money, not ten years from now, but this year, and next year. Another method for obtaining the results that such a survey would give has been proposed which, although it would perhaps not be satisfactory to all, might be continued until a better one has been worked out and accepted. The proposal is that legislation be passed authorizing a demand on every land-owner to declare the value of his holdings, or to fix a sort of upset price at which he is willing to sell his property. If that is done throughout a province, the upset value of the property in that province will be obtained. The amount of money to be raised within a municipality could be ascertained from year to year and the taxable rate would be assessed on the upset price of land within the municipality. You might say that that would not be a quite fair way to go about it. But, if we consider this for a moment, we see that it works out on an equitable basis. If owners valued their land low, the rate would be higher, while if owners valued their land high the rate would be lower, and in that way it would work out fairly and equitably. If a man values his land high and another man values his land low, the latter immediately has a purchaser for his land. He would be bound either to sell at that valuation or to raise the valuation. In that way, the system would work out equitably. That, perhaps, is not the best method, but it is one which can be put into operation within a few months and give immediate results.

MR. SHAVER: I think the system outlined by Mr. Nash is the one adopted in New Zealand.

MR. AKINS: There is a letter from one of our members who has returned from overseas, Mr. J. H. McKnight. Mr. Dennis proposes to read it.

CONSTRUCTION AND OPERATION OF LIGHT RAILWAYS IN FRANCE.

Lieut. J. H. McKnight, D.L.S.

The importance and advantages of Decauville railways were realized during the Somme offensive in 1916 and later in the fall of the same year the Canadian Railway Troop Corps was organized. At the cessation of hostilities over 12,000 troops were engaged on railway work besides 10,000 men attached from labour units.

Light railways serve as the distributors of supply which are from 6 to 15 miles behind the front line. They are of 60 centimetre gauge, or nearly two feet. At first steel rails five metres long and nine pounds to the metre were used. They were made in sections at the factory; the ties being riveted to the rail. At one end of each section a tie with a sleeve was fastened so that the next section could slip in. Although rapidly laid this was very unsatisfactory and a heavier section was made with rails 15 pounds to the metre and coupled together with fish plates and bolts. This was known as French steel. These sections while satisfactory took so much space in transportation that some design had to be adopted whereby the steel ties and rails could be assembled in the field. A steel tie was designed four feet long, eight inches wide with edges flanged downward and two pair of small rectangular holes punched so that the base of the rail would lie between each pair at nearly the required gauge. The ties were fastened to the rail by means of a bolt and a clip which gripped the rail. The ties were shipped in bundles of ten weighing about a hundred pounds and sections were assembled at any desired place. A still heavier rail of same length and 20 pounds to the metre was also used.

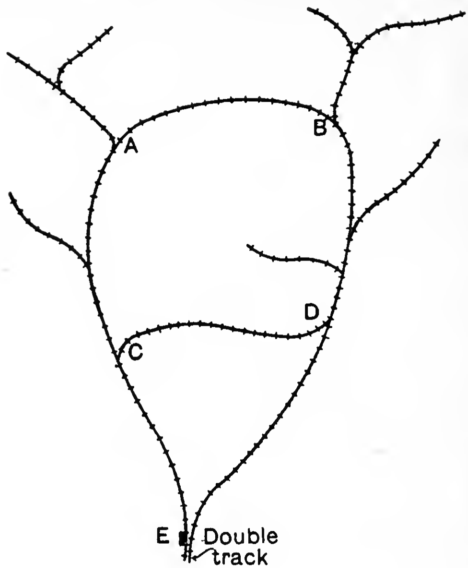
It was found that for satisfactory work a survey had to be made and levels taken. Conditions under which this work was done were at times more trying than any previous survey I was ever on, but as fair a degree of accuracy was obtained as the work warranted. The work was plotted and maps blue printed showing the location of all lines with stations, yards and sidings, ammunition dumps, important roads and other information. The work naturally fell to the lot of the Dominion Land Surveyor, together with the supervising of grading. A maximum grade of 2 per cent was allowed but we tried to keep well below this limit. On all grading in the forward area the work was done chiefly by labour units attached temporarily. On large cuts and fills mules and scrapers were used where possible. Bridge building and trestle work was done by a special party of our men and the piles were driven by a pile driver operated from power from a petrol electric engine which I shall mention later. Filling shell holes gave the most work and trouble. They were usually filled with water and where they could not be drained were often baled out by hand or pumped out. On main lines over shell-shattered ground wooden ties were used 4 and 6 feet long laid alternately. After the steel was laid it was immediately ballasted with sand, mine earth or brick ruins.

Push cars hauled by mules were used on the 9 pound rails. With the introduction of the French steel the motive power was entirely gasoline and light steam engines. A 20 h.p. gasoline engine was very satisfactory for small loads and could be easily replaced if derailed.

A 40 h.p. type was introduced with a steel covering which was shrapnel and splinter proof. This was very efficient and also a later type of petrol electric engine for hauling heavy loads which could also furnish light and power for small motors. Steam engines up to fifteen tons in weight were used but not on forward areas unless weather conditions were favourable.

Two standard types of cars were chiefly used one being flat 20 feet long, 4 ft. 6 ins. wide; the other being the same size with sides and ends 30 ins. high. The sides were on hinges and could be dropped down when necessary. Couplings were a modification of the old link and pin. The capacity of these cars was from 9½ to 10 tons and as the average capacity of a standard gauge truck was only ten tons the loads could be directly transferred car for car.

There were stations at suitable intervals connected by telephone to a central control. The usual plan was for a train to get the right of way from one station to the next and if the line was clear would be signalled to proceed. This method was used because of frequent blowouts and diversion of traffic. Where possible a loop system was used on forward areas with traffic going in one direction. The distance around the loop would be from 6 to 8 miles. This can best be explained by a diagram.



A and B are from 1,500 to 1,800 yards behind the line and about 1½ miles apart. Between C and D would be heavy siege batteries while the spurs lead to other batteries and engineer's dumps. On a similar system in the Passchendale sector 400 trains were dispatched from the central control E.

Section gangs were kept on maintenance and repair work. All lines were patrolled day and night and all breaks immediately reported. A special party with engine and car of material for repairs was kept for work at nights. This work was most trying on the men particularly because everything had to be done without a light, and on account of the danger from gas attacks and the nervous strain from working under shell fire. As many as eighteen breaks have been repaired in one night and all trains reached their destination and were unloaded before daylight. Movement of ammunition and troop trains was usually done under cover of darkness. Except during a barrage the enemy's shell fire was directed chiefly to battery positions, junction points, dumps, and where the line would parallel a highway or plank road and material was always kept handy for any emergency.

The chief uses of light railways were for delivery of ammunition especially those of larger calibre from 6 inches upward; cement, gravel and material for use of engineers and tunnellers, besides carrying troops to and from the line and bringing back the wounded. Duck boards, facines and planks were brought direct from the mills or yards well in the rear. Many of the 6 inch guns were carried on the flat cars with special frames for the wheels to positions where it would be almost impossible to get them otherwise. Salvaged material of every description was brought to the railways and carried to salvage dumps where it could be sorted. Water tanks were used for supplying drinking water to certain parts.

One illustration will show the saving of motor transport lorries. A train of four cars loaded with 300 pound shells would require 12 three ton lorries and the trip could be made as quickly besides saving a lot of labour in handling.

The daily casualties to railway battalions was not large but was constant and a large number have given their lives for their country. While not much has been said about the work done by the Canadian Railway Corps, I believe they have a record which will compare favourably with the other branches of the Canadian service.

Mr. Clarke: It has occurred to me that this is a subject which we, as engineers, should bring forward in this country. When we first got to France there were no light railways except those on which handcars were operated. As the guns increased in size and the ammunition in quantity, this means of transport became entirely inadequate. It was positively marvellous to see the work these railways did, the amount of material they handled, and the relative cheapness with which they were laid and operated. The application of such railways to the conditions of our own country struck me when I saw these railways in operation. There are many districts in our country, between which, and our broad-gauge railways, communication is necessary. One of these light railways can be pushed through much more inexpensively than a standard road could be built. In connection with lumbering and mining operations, these light railways could be most advantageously used; in fact, there are numberless opportunities for applying this system with every expectation of securing the most satisfactory results from the point of view of efficiency and economy. In connection with the mining properties in Northern Manitoba, I believe they are handling ore with teams in the winter time. Light railways could be built over the portages and connected by means of boat transportation, and in this way a great economy could be effected. Where water transportation cannot be used for floating timber from timber limits, light railways can be put in at no great expense. The laying of a light railway is apparently quite an inexpensive matter in other countries.

The meeting was adjourned until eight o'clock.

EVENING SESSION.

Town Planning was the subject of discussion for the evening meeting.

Mr. H. L. Seymour, Chairman of the Topographical Surveys Committee, presented the report of that Committee as follows:

At the last annual meeting of the Association of Dominion Land Surveyors held at the end of January, 1918, Mr. Noulan Cauchon briefly addressed the members on the subject of town planning. He laid particular stress on the fact that although nearly every province in the Dominion now has a town planning act, there are but few men in Canada qualified to engage in town planning. When the acts are made fully effective he foresaw an inrush of landscape architects from the United States unless our professional men, who should be interested in such work, take steps to prepare themselves for post-war devolopments in this line.

The whole matter of town planning was referred to the Committee on topographical surveys, which was composed of the following surveyors: J. D. Craig, W. H. Norrish, E. J. Wight, and H. L. Seymour, chairman. This Committee(after several conferences, decided that the most pressing matter was that of education along town planning lines. A meeting was arranged with the three members of the Board of Examiners for Dominion Land Surveyors (namely Dr. E. Deville, Surveyor-General; Dr. Otto Klotz, Chief Astronomer, and Mr. M. Tobey of the Geodetic Survey) and with Mr. Cauchon and Mr. Thomas Adams, Town Planning Adviser to the Commission of Conservation. These five gentlemen were named a committee with Mr. Adams as Chairman and Mr. Cauchon as Secretary to suggest subjects and text books for a comprehensive town planning course.

It was also agreed at this meeting that the engineer, architect and surveyor all have their places in town planning. Your Committee on town planning felt that the whole question was assuming proportions that made it advisable to bring it before the Executive of the Association of Dominion Land Surveyors. This was done and the further history of the town planning movement for the past season will be found in the records of the newly formed Town Planning Institute of Canada, in the formation of which the members of your Committee on town planning, resident in Ottawa, have played their part merely as individual members of the Association.

I would like to add one or two observations on town planning progress in the United States and Canada.

Practical progress has been made with land classification in New Brunswick. Probably more accuracy is needed, but the principle adopted in New Brunswick is sound. It is unfortunate that Ontario seems to be behind the times in regard to classification and scientific development of land. The new colony at Kapuskasing is being laid out according to the Ontario system of nine square mile townships. Five of these have been reserved for soldiers, and apparently each man is still allowed to select his own lot. The colonization expert of the United States Government writes as follows with regard to a visit to Canadian provinces:—

"The methods which have been worked out in land classification and in town planning in New Brunswick and by Mr. Adams respectively, seem to me so admirable that I expect to do my own little part in having these methods applied in any soldier settlement scheme which may be undertaken by the United States Government."

The United States Universities are also showing their interest in classification and town planning, and you will find the Report on Rural Planning and Development, published by the Commission of Conservation, used as a text book in Harvard, Washington, Kansas, Oregon and other American Universities. We should try to find out if the principles of classification and town planning advocated by our own people are not as good for application and teaching at home as well as abroad. It will be curious if policies advocated for ourselves, and recommending the wider scope and more extended use of our profession are ignored at home, and taken advantage of abroad.

Mr. Akins: We have with us to-night Mr. Adams, the town planning adviser of the Commission of Conservation. Mr. Adams is so well-known to the Association, having addressed it on previous occasions, that it is quite unnecessary for me to introduce him to you.

Mr. Adams: Mr. Chairman and Gentlemen, I have been asked to present to you a paper on the aims of the Town Planning Institute of Canada, and I do so in preference to making an address on the subject, because I thought that in being honoured by the request to make this statement, I should be very deliberate in what I had to say and present it to you in the form of an official statement, in so far as I could do so as an individual member of the Committee appointed to deal with this matter, at a stage in our development when we are now not able to go into details, or to inform you fully of all the facts of the case. After the reading of this paper, I understand there will be a discussion on the subject, and later on, I shall be pleased to show you a number of slides which I have brought at the request of Mr. Seymour, and which illustrate the necessary relationship between the architect, the engineer, and the surveyor, in town planning work.

AIMS OF THE TOWN PLANNING INSTITUTE OF CANADA.

By Mr. Thomas Adams.

The Association of Dominion Land Surveyors may congratulate itself on a constructive piece of work which may have considerable influence on surveying and Town Planning in Canada. A number of members of the Association, acting in concert with members of the Engineering Institute of Canada and of the Royal Architectural Association of Canada, have resolved to form a Town Planning Institute and the first steps have been taken towards the organization of the new body.

The idea of forming the Institute was born at the last annual meeting of the Association, and it is hoped that the members of this Association will take a keen interest in the development and success of its own child.

Being a Town Planner, I am glad not to have been responsible for the initial steps in forming a Town Planning Institute in Canada. I had a large share in founding the Institutes in Great Britain and the United States; but however much I may realize the importance of having an Institute in Canada, I think it well that it has been started by men who, at the time of its origin, were not practising town planners.

The Institute is being formed in spite of the desire to avoid creating a new organization, and after consideration of every alternative method of promoting education in town planning through existing Institutions. The first thought that was in the minds of the promoters seems to have been to set up some machinery in Canada to train architects, engineers and surveyors to undertake town planning work. The absence of any university course, or any special form of examination in the syllabus of the existing professional institutions, which would afford the adequate means of training for town planning resulted in the first suggestion that was made to the effect that one or both of these things should be promoted. It was then considered how we could persuade a university to give such training, or how we could get either the universities or the associations to give diplomas which would create town planning architects, town planning engineers and town planning surveyors.

To some it may seem unnecessary to give the matter of town planning special study. Is not, you might ask, every architect, every engineer and every surveyor a town planner in part? You cannot, you might add, get one man to be all three, and town planning is merely co-ordination of their trinity of activities. One trouble is that even if this were true, there is no satisfactory co-ordination being obtained under present conditions. But it is not true since the art of city making and city development leads into fields which are outside the scope of all the professions under present conditions; and secondly, a town planner has to be trained to take a comprehensive view of the matters which come within the jurisdiction of all three professions without claiming to be a specialist in more than one of them.

If we enquire deep enough into the reasons for many of the modern tendencies of thought, we shall find that there is a social element entering into these tendencies which did not exist in the years before the war. For instance, we professional men are consciously or unconsciously drawn to review our relationship with society from new standpoints in these days of reconstruction. We must consider not merely what society will pay us for our knowledge and experience, but also what contribution we have to make to society as citizens. Any professional man to-day who limits his interest to those things which will bring him money without regard to the affect on the structure of society, is lacking in patriotism and does not deserve the privileges and liberties that have been won for him by his fellows. All of us have to justify our places in the community either by having fought for its liberties, or by making a contribution towards the building up of civilization that shall be worthy of the sacrifices that have been made.

All this may seem to be placing the question of forming a Town Planning Institute on a somewhat high plane. But let us consider what the main object of such an institute is. That main object is the promotion of the scientific and artistic development of land in town and country. Probably in no direction have these new Western countries committed greater social blunders than in connection with the development of land. In spite of all our high principles of government, our democratic institutions, our keen desire to promote human well-being, our growth of knowledge and science, and our high quality of leadership in thought and public action, we have failed to show much progress as compared with older countries in the fundamental question of developing the land so as to promote health, convenience and amenity for our citizens.

A secondary object is to associate together those professional men who are interested in promoting the art and science of town planning. It is not true to say that we have failed in planning, for we have never tried to plan. The surveyor has never been asked or encouraged to do more than measure the land. The excellence and accuracy of his work in that connection deserves praise, and it is not criticism of his profession to say that land has never been planned in Canada. He has laid it out for the restricted purposes, and has done that well. He has never been asked to consider the economic use to which land was to be put, what was the most convenient method and the cheapest method of laying out land for industry, and healthy living conditions.

Our cities are not troubled with over density as a whole, but they are congested in part and under-populated in part, and both of these things are an evil. By relieving the congestion in the centres we can fill up the vacant land in the suburbs, and thus one condition can be relieved by the same remedy that will cure the other. We must avoid both bolstering up of congestion and encouraging of the speculation that scatters our population and increases our taxes so enormously.

This is not the place to enter into details and concrete illustrations. I am merely concerned with setting out some of the general principles which need to be borne in mind in connection with the application of science to urban and rural development. All I have to prove is that science is needed in these things as well as in industry, and other forms of individual and community development.

What proof is needed amongst a body of scientific men? You know the varied topographical conditions of this country, and the extent to which we make our straight lines and adapt square sections to them. You know whether our object is a develop the land or merely to measure it. You know the importance of improving transportation in cities as a means of promoting industry and relieving congestion. You know that traffic conditions require to be studied and scientifically controlled if we are to avoid waste and inefficiency. You know that every street is not required to fulfil the same needs and to perform the same functions. You know the contributory effect of density and height of building on street widths, air space and other things which are elements that go to the making of a healthy city. Finally you know that all these things and many others are overlooked and left to take care of themselves, and that no attempt has been made to deal with them on scientific principles. I need not therefore attempt to prove what is a matter of common observation and knowledge.

If then there is need to apply science to city making and to the development and organization of country life, how are we to go about it? The first step is to train men who can acquire the knowledge and experience necessary to ascertain the facts and give the kind of advice that is needed.

In this country the three professions that are primarily interested in the development of land and in the construction of streets and buildings, are the architects, engineers and surveyors. I have indicated that in the performance of their separate functions they cannot make that joint contribution to the comprehensive planning of land and buildings which is so much needed. What we need is to have a number of men in each of these professions willing to train themselves so as to apply their knowledge to wider social purposes. The architect who specializes in town planning must train himself to take a keener interest in the grouping of buildings and in the composition of whole districts, and not merely the designing of individual buildings. The municipal engineer must be encouraged to look at the problem of transportation, and of planning local improvements in a more comprehensive way, and the surveyor must be persuaded to enlarge the scope of his profession and to plan land for the purpose for which it is to be used, and not merely for the purpose of accurate measurement.

The Town Planning Institute will bring together the members of the three professions who are prepared to train themselves in town and rural planning. We cannot get that concerted effort which is so needed by asking the existing professional institutions to form separate groups of town planners within themselves. We must apparently have one united group, and we must begin without having any large number of men who have undergone special training in town planning.

To form an institute without a sufficient number of men presented a difficulty to those who have been considering the formation of the institute. It was decided therefore, that the Institute for the first year would consist of probationery members only, each of whom would undertake during the year to prepare a special thesis or study, or pass an examination satisfactory to an examining board, before being qualified for full membership.

After consideration of a large number of alternatives, we have, I think, adopted the best scheme, and one which seems to be an improvement on the kind of organization which is usually started as the basis for a professional institute. It is a weakness of all such bodies that they have to begin with a membership without approved qualifications. This does not mean that the original members of any particular institute have not been qualified, but they had no means of getting a certificate of qualification on becoming original members. We hope to overcome this difficulty by making it a condition precedent to membership that each person applying shall be a probationery member for one year, and at the end of that time shall satisfy an examining board either by passing an examination or by submitting a thesis or report of special quality to justify their election. It will come within the discretion of the body which is finally to determine the matter of membership whether the applicant can be made a full member or an associate. If he is elected only as an associate, it merely means that he has to make further studies and have further experience before election to full membership. It will not be any reflection for a man to be made an associate, because some of the busiest and ablest men who have less time to give to study may have to have the longest probationery period.

One difficulty which the proposed scheme enables us to overcome is that of selecting names of first members. Every person who applies for membership must be a member of an accredited professional institution, such as the Dominion Land Surveyors Association. Any town planning qualification must be super-imposed on the qualification of architect, engineer or surveyor.

Representatives of the surveying, architectural and engineering societies have constituted a committee and drawn up preliminary suggestions. Finally a small committee of ways and means consisting of Dr. E. G. Deville, Surveyor-General, Mr. R. H. Millson, President of the Local Chapter of Architects, and myself, have been appointed to prepare a draft prospectus and to submit a list of prospective members to a meeting to be held at an early date.

Local branches of the institute are to be formed in large cities, and a branch has already been started in Ottawa. The management of the Institute will be in the hands of a provisional council to be appointed for a year. The provisional council will probably appoint a board to hold examinations and consider other tests for membership, and all members of this examining board will have to submit to some test themselves on the conclusion of their work.

LEGAL MEMBERS.

In preparing town planning schemes, a large amount of legal work will be necessary. This will require special legal training and experience. It is an essential part of town planning, but the man who becomes learned in town planning law may never be a "town planner" in the sense in which an engineer or surveyor regards it. It is desirable, however, that lawyers who make a specialty of town planning law should be elected as legal members of the town planning institute. Provision is made in the British and American institutions for the admission of such members, and it is proposed to include them in the Canadian Institute

NON-PROFESSIONAL MEMBERS.

There will also be two classes of members other than corporate members, namely honorary members, consisting of prominent men who have taken an interest in town planning, and associates, consisting of those who have taken practical interest in town planning work without having any professional training.

THREE GROUPS.

Thus the institute will divide into the following groups:

(1) Members and associate members (architects, engineers and surveyors.)

(2) Legal members and associate legal members (barristers.))

(3) Honorary members and associates (non-professional class.)

It is hoped to have a meeting at an early date at which a final decision will be arrived at regarding the membership of the provisional council, the prospectus and regulations for admission. No doubt an inauguration meeting will be held when it is hoped that the co-operation of other professional institutions will be obtained.

For the present I have said as much as I can say publicly with regard to the institute. I am sure that we all wish it a career of prosperity, and not because of any professional object which we may have in view, but because of our knowledge of the need of applying more art and science to an important part of the foundation of the social structure of Canada.

I am certain that the formation of such an institute will strengthen the professional status of the members of those professions which are directly interested in town planning, and I think such strengthening is necessary in Canada.

No one respects the profession of law as it is practised under our British constitution, and by men of high qualifications and integrity in all our communities, more than I do. It is not inconsistent with that respect, to say that the other professions in the country have not been given, or let me put it, have not taken their fair share of responsibility in its government and particularly in the settlement of technical problems. The fault may lie with the professions who have not been given the responsibility, but wherever it lies it is a misfortune.

EXECUTIVE ABILITY OF ENGINEERS AND SURVEYORS.

There has actually been an idea abroad that executive ability is a thing apart from and not capable of being combined with scientific knowledge. We know, as a matter of fact the combination of both is necessary for satisfactory administration, and our knowledge is supported in a most striking way by what has happened in the last few years.

A professor of political economy is chief executive of one of the most powerful nations of the world. The work in the United States which, next to Presidency, requires the greatest amount of executive ability,—food control,—has been carried out by an engineer. A county road engineer in England before the war was made Brigadier-General in charge of road planning and construction in France. Recently in Canada an engineer was made President of one of our greatest railways.

When the City of Dayton decided to appoint a manager at the highest salary paid for a city executive it appointed an engineer.

A Toronto engineer who went overseas with the first contingent of our forces became the chief intelligence officer of one of the British Armies, a post requiring executive ability of the first order. Railway engineers have been appointed as heads of Naval and Home affairs during the war in defiance of precedent and claims of seniority, where vested interests are usually supreme.

But in Canada, when we want to determine whether a bridge is sufficient to carry a given volume of traffic we appoint three legal gentlemen to settle it; when one of our Provinces wants a technical report on housing it appoints no architectural member, and generally there seems to be a disposition to dispense with technical skill in the higher branches of administration.

I believe the time will come in Canada, revolutionary as it may appear, when we will actually be able to get our public authorities in Canada to appoint engineers to settle engineering problems, when architects will be appointed as members of committees on selection of sites for buildings and to settle other architectural questions, and when surveyors will be considered fit persons to sit on land settlement boards. That may be a wild dream, but it will be attainable as soon as the three professions I have named have arrived at an adequate conception of their own value and of their responsibility to the community.

In conclusion I would draw your attention to the progress of the British Institute formed in 1909. It comprises in its membership all the prominent architects, engineers and surveyors who have practiced town planning. Its President this year is Professor of Town Planning in London University. Town planning is also taught in Liverpool and Birmingham Universities. Town planning architects and engineers have supervised the great war housing schemes of the British Government, and will control the plans to erect 500,000 houses in England as part of a reconstruction policy of the country.

The United States had a chief town planner in charge of the layout of all its housing schemes, and has town planning courses in many of its universities.

The duties of the surveyor touch every aspect of town planning. He must prepare the topographical survey and map of land classification which must precede all town planning. He must prepare the accurate topographical map of all our existing cities which we have found from experience must precede the preparation of any town planning scheme. Town planning schemes in Canada are being delayed for want of these maps. Surveys of industrial regions like Montreal Island and a large part of the Niagara Peninsula are needed to help us to solve the problems of efficient industrial distribution, transportation, economic use of land, and housing.

A new Canada is in the making to-day. It will be born out of the sacrifices of the heroes who have fought that our civilization may endure. It will be developed and built up by those of its citizens who in coming days will be prepared to make their contribution to the same end, but by means of peaceful reconstruction instead of war. We have made mistakes in the past, but none we cannot remedy. But we may make the greatest mistake of all in the future if we act is if our national problems consisted of re-adjustment to old conditions instead of re-construction on new foundations of science and social justice. In the laying of that foundation your profession has a great part to perform.

Mr. Akins: We are very much indebted to Mr. Adams for the able presentation that he has made of this important subject. Amongst other gentlemen who are with us to-night and who will discuss this question is Mr. Cromarty, who has been Professor of Architecture in the University of Alberta. He is now doing architectural work for the Invalided Soldiers' Commission in Ottawa.

Prof. W. D. Cromarty: I suppose I am called upon to say briefly a word for architecture. I hope surveyors do not regard architects in the same light as the bricklayer who, working on a house and seeing the architect approach says: "Here is the architect; let us heave a brick at him." Architects have had many bricks thrown at them. That attitude is frequently manifested in connection with engineering work. I remember an engineer who had been commissioned to put up a factory chimney. He did not feel safe about it and he said: "This is out of the ordinary; I had better hand the job over to some architect." I remember another engineer who was shown a design of a tower to be erected in Ottawa, and when he had expressed great admiration for it, the architect said: "We will have to change that, because if the engineer likes it there must be something wrong with it."

However, in the matter of town planning, architects are not unpractical. In the United States, architects have been among the leaders. It is appropriate that they should be, because they are essentially philosophers and they must study this question from the different angles which it presents. I think that is essential. I believe that the cardinal sin in town planning is piecemeal, patchwork. Let us work upon a well-planned scheme. In the first place, in making a town plan, we should consider the strategical position, the position in regard to the surrounding centres of population, its natural resources, social conditions, the possibility of attracting manufacturers, and the inducements it offers to visitors. Then, we would like to realize and reduce to the ideal, the industrial centre, the park centre, the recreation centre, and the housing district. With all these the architect is obviously concerned. Apart from that, architects are invariably good citizens. I believe the time is coming when even Mr. Adams will say that they are as worthy as the munition manufacturer, or the broker.

We know by experience that the rural question is just as important as the urban, and, in one sense, will probably be more important. I do not know anybody who will realize that as clearly as Mr. Adams has done, and who has stated the case so ably. A little while ago I read a review of his last report, a review written by a man of distinction, and he concluded by saying that there was no one who had such a philosophic grasp of the whole situation, and of its many ramifications, as Mr. Adams. I am sorry that Mr. Adams is not an architect. In spite of his want of knowledge of architecture, we have to yield the palm to the surveyors, and it is not the only debt we owe them, that, with the engineers, they have given us this opportunity of forming the Town Planning Institute of Canada.

Mr. Akins: Mr. Cromarty has defended the architects. We will now hear the views of the engineers from Mr. McCallum, the Commissioner of Works in Ottawa.

Mr. A. B. McCallum: Mr. Chairman and Gentlemen, there are one or two things which Mr. Adams has been saying that I would like to refer to. Mr. Adams' voice has been like the voice of one crying in the wilderness; for a long time he was engaged in pointing out the way, without anybody listening to what he was saying. He came to this country and found every town and city laid out regardless of how it should grow, and according to how the real estate promoters thought it would go. I do not know of any city in America that has really been planned. The older parts of Ottawa were laid out by the Royal Engineers years ago, and in those parts we have wide streets. Afterwards the real estate men got to work and the consequence is narrow streets, such as Sparks streets, and the streets leading up and down from that. In Toronto you have Yonge street, the main artery of the city, and yet there is not another street, from the first to the second concession. until you come to Spadina avenue in the middle western portion of the city. The reason for that is that the surveyor had to get the greatest number of lots out of a given area of land. The greatest diffiuclty we have is to prevent real estate men from having streets laid out, which, instead of being carried on continuously, will form dead ends. You will see follies like that in Hamilton and other places. Nearly all the cities have followed this lay-out.

There are some engineering details that I will touch upon, and one of these is the question of alley-ways and lanes. They are not picturesque but they are practical. I have found that the existence of alley-ways and lanes cuts down the cost of garbage collection about forty per cent. In this city our garbage collection cost $70,000, and in Hamilton it costs about $40,000, a year. The reason is that where you have alley-ways the receptacles can be put down there, and two men with a team can go along and collect them very quickly. Poles, conduits, and a number of those things could be put through the alley-ways and lanes, instead of upon the streets. Another detail in connection with laying out a town is that the lights should be so placed on the streets that street names and numbers can be readily seen at night. To a stranger coming to a city it is very difficult to see the name of the street at night, and much more difficult to see a street number. Hamilton has the best arrangement. Directly under every arc light at the corner is the name of the street. Nearly all the cities follow the plan of having a dark background with white letters. You can walk up or drive through a street and see the name when you come to it. Here we have to get close up to the street corner to see the street sign.

With regard to railway entrances, the great drawback is that in the older cities and towns they wanted the railways so badly that they would pretty nearly allow them to come into their main streets as an inducement to them to enter the place at all. As a result of this policy, in Ottawa the city is cut in two by the Grand Trunk, and all the up and down streets with the exception of Elgin and Bank streets are blocked. The residential part of Hamilton is cut to pieces in the same way by the Toronto, Hamilton and Buffalo Railway. It is practically the same with the northern part of Toronto. Now, they are separating the grades in all the cities. That is a matter that is going ahead all the time. In the United States to-day, there is one state where they are eliminating one grade crossing each year, the state paying the land damages, and the railway paying the cost of construction.

There is one thing I have noticed in connection with suburban areas. Very often, in suburban areas, there is a tendency to lay out streets in curves and circles. While that may have a very pleasing effect to the eye, the engineer sees the reverse side of the picture. It is hard enough to get a straight sewer pipe laid tight, but when you have to deal with curves you are apt not to get the pipes tight, you have to keep your manholes closer and you cannot inspect the pipe. The same remarks apply, although not to quite as great a degree, to water mains. Water mains are very seldom inspected, except in the case of a leak. In the case of sewers, it has a very bad effect because your sewers are always blocked. Tree roots grow into the sewers and it is a case of digging down into the street in order to get at the sewer and to clear the obstruction.

The automobile has affected curves and street corners. Unfortunately, in this city, we have a blockade, in the form of a telegraph pole at every corner, and we occasionally have a six to eight degree radius instead of the curve being flattened. If we had not these poles the traffic could turn almost at right angles and keep close to the curb. That is the way it is handled in nearly all of the cities where the poles are not on the corner, but here it is out of the question.

There are only one or two other things that I would like to note. One is the question of grades. A lot of misleading information has been given out with regard to that. I have noticed in different magazines statements with regard to the different grades that different things will stand. When you get down below a three per cent grade you can put in any pavement; when you get over four per cent you eliminate wood blocks, and when you get over three and a half per cent, you eliminate asphalt. I laid an asphalt pavement on a seven and a half per cent grade on John street, Hamilton. We called it an asphalt pavement, but when you get grades up to ten per cent you are practically limited to one or two pavements, and some of them are very expensive. You are practically limited to stone or hillside brick.

Another point in connection with the topography of the town is the question of elevation. When your town is laid out, try to keep it as flat as possible. The ordinary house service will stand a pressure of from 118 to 120 pounds. If you have 120 pounds at the lower end of your town site and work to that so that at the highest point you have a pressure of from 30 to 40 pounds, you will get along all right. If not, you must put in a booster, which will raise your costs of operation.

If engineers and surveyors have not taken the part they should have taken in town planning, or i nengineering work, in connection with the war, it is the fault of the engineers and surveyors. Of the engineer regiments that went out, one was in charge of a druggist, another in charge of a lawyer, and another in charge of a practical man. That such should be the case is altogether the fault of the engineers and surveyors. You probably come from different towns, and I will guarantee that there is not one man in twenty amongst you who takes any interest in the municipal life of the city he comes from. You will probably go to a meeting in connection with some local question which may affect you in an engineering or surveying sense, and you will take a back seat, and instead of getting up and saying what should be done, you will probably remain silent and express your views afterwards. Engineers and surveyors are to blame because they will not assert themselves. If they would do so, they would have some effect politically, and I believe in having an effect politically. The only way you can have an effect politically is to have a certain influence behind.

Mr. Seymour: When Mr. McCallum referred to curves, I have no doubt that he had in mind sharp curves. We should have a curve with a radius sufficient to allow of an unobstructed view for 200 or 300 feet, with the man-holes that distance apart. If the curves are of a sufficient radius to give you that, there will be no trouble in regard to sewerage.

Mr. Akins: We have listened with great pleasure and profit to the views expressed by the architects and engineers. We will now listen to a presentation of the matter from the viewpoint of the surveyors, and I would ask Dr. Deville to address you.

DR. DEVILLE: So far as Dominion Land Surveyors are concerned, they are interested mostly in rural development. Town development comes more properly within the duties of the Provincial Land Surveyors. In connection with the work of the Dominion Land Surveyors, the tendency has always been to get rid of them as quickly as possible. The subsequent development of the land is entrusted to anybody, so long as he is not a Dominion Land Surveyor. It seems to be incumbent on the Dominion Land Surveyor to have nothing more to do with the land after he has planted his posts. That is not the proper attitude, and I think we are going to have a change, if I read the signs of the times aright. Canada is an agricultural country. If the farmers are prosperous, Canada will be prosperous, and not otherwise. It is not all the planting of posts; that is only the beginning. The subsequent development involves a great deal more work than the mere laying out of the boundaries. There is the laying out of a system of roads. This work, in the western provinces at least, is largely in the hands of the land surveyors. Not only are they laying out the roads but they are the builders of the roads. They are doing the work under contract with the municipalities. But that is not all. There is a great deal more than that to be done. We can see that there is a great deal of unrest among the workers of the world, more in the old country than here, although it seems to be coming our way, and I do not think we will escape it. What does that mean? It means that the workers are not anxious to continue working under the same conditions as those under which they were working before the war. During the war, they had been able to impose their terms and to say: "We want to have this," and "We want to have that." They generally got what they wanted. They do not want to go back to the conditions before the war. They want better conditions, and they want better service, and that can only be accomplished by greater efficiency in all the organizations which have to do with their settlement. That applies especially to the settlement of land. The time is past when it will be possible to dispense with the services of the men who are best qualified to do that work. I think the time will come, sooner or later, when the surveyors, who are the men best qualified to deal with rural settlement, will have to be employed to a much greater extent than they have been in the past.

MR. AKINS: We have with us Mr. Simpson, who is an industrial engineer, and who has taken a keen and constant interest in town planning. We will be very glad to hear from him.

MR. LOUIS SIMPSON: Mr. Chairman, I would congratulate you and all present upon the new departure that has been made in connection with the organization of an Institute of Town Planning. For thirty-two years I have made a study of the construction of houses to be occupied by industrial workers, and I came into the question from the practical end and not from the architectural one. I have always felt that one of the difficulties of housing workingmen employed in large factories, under conditions that are sanitary and comfortable, and yet only call upon them to pay a rental within their power, was to interest people who have money to invest and to assure them of a return equal to what they would get if they were buying bonds. It is all very nice, no doubt, to build garden cities and towns, but they cost money. We have to face, first of all, the practical end of it. Let us get comfort first, which includes sanitation, and then go in for the frills afterwards.

What I have been fearful of is that we have talked more about appearance than about the essentials of comfort and sanitation. We should divide the essentials of town planning into two. There is the town planning in connection with which we would call in the landscape gardener and the architect, and there is the town planning which provides for comfort and sanitation. When you have your Institute started all these matters will be thoroughly threshed out. I was pleased to hear the words of Mr. McCallum in which he approved of back lanes. I have adopted that plan in connection with a new industrial town in the Province of New Brunswick. I have tried every design I could think of, but I have always to go back to that providing for back lanes.

Mr. Rannie: As a member of the Association of Dominion Land Surveyors, I am pleased to see the broadened effort of the Association's activities as evidenced by the interest it has taken in town planning. From time to time I have felt that the Association was perhaps a little too narrow in its application to the different problems which confront us. I feel that this Association has an unique standing and that the words: "Dominion Land Surveyor" confer upon the person who is entitled to write them after his name, a position of honour and distinction among his fellows. As time goes on, the work of actually measuring and surveying the land is becoming less and other avenues of usefulness are opening up to Dominion Land Surveyors. It is only natural and fitting that the Dominion Land Surveyors' Association should take a deep interest in the question of town planning. Mr. Adams has pointed out that one of the essentials of town planning is the proper mapping of the areas dealt with. Town planning, as it is affected by city mapping, is of great interest to the Geodetic Survey branches, and I am very glad that the Association is, to some extent, helping this work. The Geodetic Survey of Canada, at many centres, is able to give the secondary triangulation control which will help in the greatest possible way in carrying out the work of city mapping which must always be a basis for the operations of town planning.

Dr. Klotz: I saw a paper this morning prepared by Mr. Lafarge, the architect, who has been acting for the United States Government in connection with house planning. The United States appropriated $100,000,000 for houses to be built in connection with war work. They got together at Washington all the experts they could think of, such as architects, engineers, surveyors, town planners, and so on. They apparently got their Efficiency Committee together and started work. Mr. Lafarge describes all this in a very interesting way. This is not an imaginary city that the writer of the paper is talking of, but a description of what is actually taking place. The great pity is that this house planning scheme suddenly fell down on the signing of the Armistice. That fact is greatly deplored by Mr. Lafarge. He gives the most interesting description of suburban villages actually constructed in connection with munition plants. This work was undertaken last fall, but it is over for the most of them except those houses on which thirty-five per cent of the cost has already been spent. They will be completed. As to the others, it is stagnation, although it is not permanent stagnation. I was pleased to see this practical demonstration of what we are striving to carry out here.

Before sitting down I would like to supplement the remarks of the Hon. the Minister of the Interior who at luncheon to-day told us that 90 per cent of the Presidents of the United States had been lawyers. I am glad to add that the two greatest Presidents—Washington and Lincoln—had both been surveyors. (applause).

Mr. Adams: I have listened with a great deal of pleasure and interest to the discussion. That portion of it which relates to the details of town planning, I will not touch upon because, obviously, the only question which I would need to refer to in that respect, is already dealt with in the paper which I have presented. The discussions which have taken place, in regard to various town planning questions like back lanes, and curves, are interesting as showing the need for a Town Planning Institute. We need an exchange of views. I think we might use the curve and the back lane the same as we use the rectangular curve; neither is desirable nor useful for every possible condition. We cannot lay down a rule to apply to every possible condition; each case has to be considered upon its merits. In the case which Mr. Simpson mentions, he is laying out a new town, and all I can say is that there is nothing better than to introduce back lanes under those conditions. But it is another matter where we are planning to improve conditions in an existing city or town, where we must have regard to conditions as they exist.

In regard to the question of the Institute, I think the fact that no criticism has been brought to bear upon it is rather ominous. I remember Mr. G. K. Chesterton once saying, when we were talking about a garden city: "We have nobody saying anything against it; and when you have nobody saying anything against a thing you know it is going to come to a bad end." We should have some criticism about the Town Planning Institute, in order to feel sure about its future. However, I do not take the same view of it as Mr. Chesterton; I would rather interpret the silence of the public as meaning approval of our work.

There are only two points that I would like to touch upon in conclusion. The first is the importance of the profession in Canada taking the question up in order, not to prevent United States men from coming over to help us, but to make it possible for this work to be done by our own men. I have many friends in the United States, whose work will be useful to us, but, after all, there is no use of us starving in Canada and allowing the fellows to come over from the United States and get the work. And, there is a great deal of work to be done, a fact that has been impressed upon me on several occasions. On one occasion I went to Montreal to see a gentleman, and he submitted to me a sheaf of recommendations of town planners who were willing to be employed to plan a new town that he wanted to build. They were all from Boston, New York, Chicago, and other places in the United States, and there was nobody from Canada. I had to use a great deal of persuasion to get one or two Canadians an opportunity to undertake that work. Another instance happened where a United States firm of architects was engaged to prepare the plan for a town in the Province of Quebec. Other cases will certainly arise in the future, unless we endeavour to educate and train our own men. That is a point which you ought to take to heart.

In regard to the broadening of your own profession, I think it will become a great force for the building up of a useful and honourable profession in this country.

A number of excellent stereoptician views were thrown upon the screen to illustrate the different phases and problems of town planning, dealt with in Mr. Adams' paper.

On the motion of Mr. Hawkins, seconded by Mr. R. H. Millson, a resolution expressing the thanks of the Association to Mr. Adams was adopted.

The session concluded at 10.30 p.m.

FRIDAY, JANUARY 30TH, 1919.
MORNING SESSION.

Mr. Rannie, Supervisor of Triangulation on the staff of the Geodetic Survey of Canada, made a report on behalf of the Geodetic Surveys Committee, as follows:

The items of Geodetic interest that I can bring to the notice of the meeting are three or four in number. I shall only deal with them very briefly; in fact far more briefly than they should be dealt with, having regard to their importance. They are not new to you. One of them is the matter of the North American datum which was adopted in 1913 by Dr. W. F. King as the datum for the triangulation of the Geodetic Survey of Canada, after consultation with the United States Coast and Geodetic Survey. It takes a rather long time to explain the economy of the Canadian survey accepting what was then called the United States Standard Datum, as the datum of our surveys. A datum must start on the basis of astronomical determination which, however, may be considerably in error, due to the unequal distribution of densities over the earth's surface, and not through any inaccuracies in the observations themselves. For example, on the island of Porto Rico, the United States Coast and Geodetic Surveys established astronomical stations on the north and south sides of the island, but when the stations were connected by triangulation they found that these two points were actually about 1 mile farther apart than they had been shown by the astronomical determinations. Down on the St. Lawrence River the Naval Department have found much the same state of affairs; the triangulation positions of astronomical stations on both sides of the St. Lawrence do not agree with the astronomical determinations of these same points taken some years ago. It is only after a great number of astronomical stations have been established and these points connected by triangulation that the discrepancies can be analyzed and the true datum found. It was in this way that the United States Standard Datum was obtained after connecting some 600 astronomical stations by triangulation. It was felt that a great deal of time and money would be saved for Canada by the adoption of the United States datum, which was re-named the North American Datum. It was also accepted by the Mexican Geodetic Survey as well as our own.

Another point that I wish to bring to your attention is the probability, in the next few years. of there being an adjustment of the precise levels in eastern Canada by the Geodetic Survey. The progress of precise levels in Eastern Canada is probably far enough advanced that the adjustments may be make very shortly.

You can see that this report takes up matters of geodetic importance, which may be of interest to all Dominion Land Surveyors. There is a feeling among Canadian geodesists that their work should be of increasing service to the whole country, and an effort is being made to supply the exact needs of those who require the data obtained by the Geodetic Survey of Canada. In this connection it may be said that what seems to be absolutely required is a closer connection between the primary triangulation and the topographer and hydrographer. You will realize that topographers and hydrographers are not going to go back six miles through the bush to tie their surveys on to a primary triangulation station away up on a hill, if by so doing they lose the accuracy that they expect to gain by tying their surveys to a primary triangulation station. Hence what we of the Geodetic Survey of Canada are trying to do is to get down from the primary triangulation, wherever it is required, in order to get points which are needed by these various organizations. For instance, on the St. Lawrence River the Hydrographic Survey needs the positions of lighthouses and church spires along the coast. We cannot always help the Geological Survey topographers as much as we would wish, because they require more points to control their maps than we are able to give them from our primary triangulation. The Militia Department mappers, require the geographical position of points throughout the country, which may be triangulation stations, church spires, etc. The Chief Geographer also requires the geographical position of land survey corners near the triangulation stations, in order that he may be able to co-ordinate the results of the different surveys. These matters are receiving the attention of geodesists in order that they may bridge the gap between the primary triangulation and the needs of these different organizations, and in order that they may give these different organizations and the people generally what they require in the very fullest possible manner.

There is just one other point that I might briefly mention, and that is the need in this country of standards of measure. You will remember the discussion that took place last year in this regard. That need of a standard, or correlation of standards in this country, is as necessary as it was before. The need of legislation in that regard was brought up at the last annual meeting, and you all read the discussion in the annual report of the 1918 meeting starting at page 118.

Mr. Akins: We have with us this morning, Mr. F. E. Buck of the Experimental Farm, who would like to speak a few words.

Mr. Buck: Mr. Chairman and Gentlemen, I am not altogether a stranger to these meetings, as I have attended them often and had the privilege of being present last year. My work which has to do with landscape architecture and horticulture, brings me very frequently into contact with surveyors. I am here, however, this morning, as a member of the Ottawa Horticultural Society, in the interests of a resolution which one of your members will present. The resolution asks you for your support and co-operation in regard to a scheme looking to the inauguration of "peace parks" throughout the country. This resolution has been approved of by the Ottawa Horticultural Society, and will be submitted to the Ontario Horticultural Association at its convention to be held in Toronto next week.

The scheme consists briefly in advocating the extension of the playgrounds idea throughout all the cities and towns of the Dominion. In large cities like Ottawa, Toronto, and Montreal, Playgrounds Associations have been organized, playgrounds for children have been established, and a lot of excellent work has been done. This scheme should make a very special and particular appeal to the delegates to this convention to be held next week from small towns which have no playgrounds associations, and where facilities for children are lacking entirely except such as are provided in connection with schools. We hope, through the organization which I have mentioned, to spread this idea through the country to a large extent and the matter will be made the subject of a resolution there and fully discussed. As far as Ottawa is concerned, we have thought the matter out in a somewhat elementary way and a plan has been prepared with a view to trying out a venture of this nature in this city. The Playgrounds Association has various areas scattered throughout the city. We do not intend to discourage this movement or lessen these areas, but we hope to increase the number of areas, to get the civic grants increased, and to receive greater encouragement from the public. These peace parks take the form of playgrounds, and will become memorial parks, and will inaugurate a system which will be among the things that we had hoped to bring about in connection with peace.

This proposal is quite in line with the work outlined in the address of Mr. Adams last night. It will advance the interests of the cities and towns throughout the country and recognize the obligations which every community owes to the rising generation . The Ottawa Association invites the co-operation and collaboration of other cities in connection with it, because there is not only the practical working out of the scheme but there is the financing of it to be considered. That is not a difficulty in so far as Ottawa is concerned, and I imagine it will not be a difficulty in smaller cities or towns throughout the country, because there is always a possibility that we may interest, not only municipal corporations, but wealthy citizens in the idea of peace parks, with the result that they will be able to contribute to their establishment and support. The blessings that democracy brings must, in a large measure, come from democracy itself, and that is why, in a city like Ottawa, we seek to interest every organization in a movement of this kind.

MR. BARBER: After Mr. Buck's explanation I do not think it is necessary for me to do anything more than simply make the following motion:—

"That the Association of Dominion Land Surveyors places itself on record as favouring the idea of the establishment of Children's Peace Parks throughout the cities and towns of the Dominion, and signifies its willingness to collaborate with other organizations in obtaining such parks."

MR. SEYMOUR: I beg to second the resolution.

MR. WALLACE: I would like to ask Mr. Buck if he has not found motors a very great trouble. We had two fine parks, but they have been ruined by the selfishness of motorists.

MR. BUCK: In Ottawa and other large cities playgrounds have been guarded against damage of that sort owing to the fact that they are small and are looked after by supervisors. These peace parks will be looked after in a similar way.

With regard to the scheme throughout the Dominion, it is in the minds of some of us that it should be looked after by a Dominion organization, consisting of representatives of such associations as your own, town planning institutions, and other organizations, specially qualified to work out a Dominion-wide scheme, which might be adapted to the particular needs of each town.

The resolution was unanimously adopted.

AFTERNOON SESSION.

The Meeting proceeded to consider the draft Constitution and By-Laws which had been introduced at a previous session. Letters were read by the Secretary from J. N. Wallace, J. D. Alexander, F. H. Peters, H. E. Reid, and W. H. Norrish. The clauses were taken up in detail, many amendments weer introduced, and the new Constitution and By-Laws finally adopted by unanimous vote.

The nomination and election of Officers then took place, the results being as given elsewhere in this Report.

The Secretary was instructed to convey the thanks of the Association to all who had contributed to the success of the Meeting by reading papers and by making addresses, and also to Mr. W. J. Sykes, for the use of a hall in the Public Library Building, and to Mr. J. B. Harkin for the loan of a lantern.

The meeting was adjourned.

LIST OF MEMBERS.

Patron:

E. Deville, LL.D., I.S.O., D.T.S., Surveyor General, Ottawa.

Honorary President:

Otto Klotz, D.Sc., D.T.S., Chief Astronomer, Ottawa.

Honorary Members:

R. H. Campbell, Director of Forestry, Interior Dept., Ottawa.

Hon. J. P. B. Casgrain, D.L.S., Senator, Ottawa.

J. S. Dennis, D.T.S., Asst. to President of C.P.R., Montreal.

C. A. Magrath, D.T.S., Ottawa.

W. J. Stewart, Chief Hydrographer, Naval Service.

P. B. Symes, Esq., Ottawa.

Past Presidents:

Major E. W. Hubbell - - -	1907-8
R. E. Young - - - - -	1909-10
T. Fawcett - - - - -	1911
P. R. A. Belanger - - - -	1912
C. F. Miles - - - - -	1913
C. F. Alysworth - - - -	1914
A. H. Hawkins - - - -	1915-16
J. J. McArthur - - - -	1917
J. N. Wallace - - - - -	1918

ACTIVE MEMBERS

Note: Members whose names are marked thus * enlisted for Overseas Service.

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Akins, James Robert, B.Sc.	1910	1912	Topographical Surveys, Ottawa.	108 Strathcona Ave., Ottawa
Alexander, John Bentley, B.Sc.	1914	1918	Thomas Block, Calgary	
Aylsworth, Charles Fraser, O.L.S.	1886	1907		Madoc, Ont.
Baker, Mason Herman, O.L.S., Grad. S.P.S.	1908	1913		Scarboro, Ont.
Barber, Herbert George, Grad. S.P.S.	1908	1910	Topographical Surveys, Ottawa.	10 Thornton St., Ottawa
Bartley, Thomas Holmes, B.A.Sc., O.L.S	1913	1916	Topographical Surveys, Ottawa.	Carleton Place, Ont.
Bayne, George A., M.L.S.	1872	1907	c/o H.B. Co. Winnipeg	
Beatty, David, O.L.S.	1872	1907		Parry Sound, Ont.
*Beatty, Frank Weldon, Grad. S.P.S.	1914	1915	Topographical Surveys, Ottawa.	Pembroke, Ont.
Benner, Frederick James King, O.L.S.	1915	1918		Port Arthur, Ont.
Bennett, George Arthur, Grad. S.P.S.	1910	1912	Topographical Surveys, Ottawa.	Tillsonburg, Ont.
*Beresford, Lt. Henry Edward, M.B.E., M.L.S.	1913	1914		Portage la Prairie, Man.
Beresford, Herbert Graham, M.L.S.	1915	1915		359 Ingersoll St., Winnipeg
*Berry, Edward Wilson, Grad. S.P.S.	1911	1913	7 Thomas Blk., Calgary	
Bigger, Charles Albert, O.L.S., B.C.L.S.	1882	1910	Geodetic Surveys, Ottawa	145 Gloucester St., Ottawa
Bingham, Edwin Ralph, O.L.S.	1906	1909		118 Victoria Ave., Port Arthur, Ont.
Blanchet, Guy Houghton, B.Sc.	1910	1911	Topographical Surveys, Ottawa.	110 Frank St., Ottawa
Boulton, William James, Grad. S.P.S.	1912	1913	Topographical Surveys, Ottawa.	
*Bowman, Lt. Edgar Peterson, Grad. S.P.S., O.L.S.	1907	1912		West Montrose, Ont.
Brabazon, Alfred James	1882	1907	Geodetic Survey, Ottawa	

ACTIVE MEMBERS—*Continued.*

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Bray, Samuel, O.L.S.	1883	1910	Chief Surveyor Dept. of Indian Affairs, Ottawa	229 Argyle Ave., Ottawa
Brenot, Lucien	1910	1910	Topographical Surveys, Ottawa.	297 Clemow Ave., Ottawa
Bridgland, Morrison Parsons	1905	1910	7 Thomas Blk., Calgary	1950-13 St. W., Calgary, Alta.
Brown, Thomas Wood, Grad. S.P.S.	1909	1912	Box 438, Saskatoon, Sask.	
Brownlee, James Harrison	1887	1910		San Francisco, California
Bruynseraede, Rene	1916	1917	Topographical Surveys, Ottawa.	Box 597, Red Deer, Alta.
Buchanan, John Alexander, Grad. S.P.S.	1912	1913	Topographical Surveys, Ottawa.	10234-122nd St., Edmonton
Burgess, Edwin Le Roy, Grad. S.P.S., O.L.S., B.C.L.S.	1905	1907		Kamloops, B.C.
*Calder, Lt. John Alexander	1912	1912		Ashcroft, B.C.
Campbell, Alan John, B.C.L.S., A.L.S.	1909	1915		Sidney, B.C.
*Cannell, Herbert William	1913	1913	Topographical Surveys, Ottawa.	
Carson, John Alton, B.Sc., B.C.L.S.	1914	1917		1625-8th Ave. W., Vancouver
*Carthew, Lt. John Trewalla	1913	1913		Edmonton
Cautley, Richard William, A.L.S.	1896	1909	523-6th Street, Edmonton	Edmonton
Chase, Albert Victor, Grad. S.P.S., O.L.S., A.M.E.I.C.	1910	1912		Orillia, Ont.
Christie, Uriah Wesley, O.L.S., Grad. S.P.S.	1908	1913		Port Credit, Ont.
Christie, William, Grad. S.P.S.	1906	1913	Topographical Surveys, Ottawa.	Prince Albert, Sask.
Christie, Gerald Moffat, B.C.L.S.	1917	1917		Kamloops, B.C.
*Clarke, Lt. Roger Fyfe, M.C., B.Sc.	1914	1914		358 Ottawa St., Hamilton, Ont.
Clements, Frederic Simon, B.C.L.S.	1905	1912		Box 49, Prince Rupert, B.C.
Cleveland, Ernest Albert, B.C.L.S.	1899	1909	1001 Rogers Bldg., Vancouver	
Clunn, Thomas Henry Gwyther	1908	1910	M.L. & Y. Br. Dept. of Int., Ottawa	119 Fentiman Ave., Ottawa
Cochrane, Morton Farrer, P.A.S.I.	1908	1909	Dom. Water Power Br. Dept. of Int., Ottawa	400 Daly Ave., Ottawa

ACTIVE MEMBERS—*Continued.*

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Coltham, George William, B.A.Sc., O.L.S.	1913	1913		Aurora, Ont.
Coltham, James Thomas, O.L.S.	1915	1918		Aurora, Ont.
Coté, Hon. Jean Leon, M.P.P.	1890	1907	Provincial Sec., Edmonton, Alta.	Edmonton
Coté, Joseph Martial	1913	1913	Topographical Surveys, Ottawa.	72 College Ave., Ottawa
*Coté, Lt. Joseph Aurele, Grad. R.M.C.	1911	1914	Secretary D.L.S. Board of Examiners, Ottawa	
Cotton, Arthur Frederick, B.C.L.S.	1880	1910		New Westminster, B.C.
Cowper, George Constable, B.A.Sc., A.L.S., A.M.E.I.C.	1911	1912	Topographical Surveys, Ottawa.	131 Fentiman Ave., Ottawa
Craig, John Davidson, B.A., B.Sc.	1902	1909	Boundary Surveys, Ottawa	593 Besserer St., Ottawa
Crouch, Milton Edwin, Grad. S.P.S., O.L.S.	1914	1916		Box 57, Nipigon, Ont.
*Cumming, Capt. Austin Louis, B.Sc., A.L.S.	1910	1910	Topographical Surveys, Ottawa.	Cornwall, Ont.
Cummings, Alfred F., B.C.L.S.	1909	1913		Fernie, B.C.
Currie, Peter William, B.Sc.	1902	1907	Survey Records, Int. Dept. Ottawa	92 Argyle Ave., Ottawa
Daly, William Patrick	1916	1918	Topographical Surveys, Ottawa.	88 Sunnyside Ave., Ottawa
Davies, Thomas Atwood	1906	1911	Topographical Surveys, Ottawa.	
Day, Harry Samuel, B.Sc., A.L.S.	1911	1911		Edmonton, Alta.
Deans, William James, O.L.S.	1886	1908		Brandon, Man.
*de la Condamine, Oscar Charles, A.L.S.	1910	1912		Calgary, Alta.
Dennis, Earle Munro, B.Sc.	1908	1911	Topographical Surveys, Ottawa.	64 Aylmer Ave., Ottawa
Dennis, William Melbern, B.Sc.	1911	1912	Geodetic Survey, Ottawa	261 Powell Ave., Ottawa
Dickson, Henry Godkin	1889	1907		Whitehorse, Y.T.
*Dillabough, Major James Vidal, B.Sc.	1910	1912		141 Eugenie St., Norwood, Man.
Dodge, George Blanchard, A.M.E.I.C.	1909	1909	Topographical Surveys, Ottawa.	12 Thomas St., Ottawa
*Donnelly, Cecil, B.C.	1913	1913		Winnipeg, Man.
Doze, Joseph Wilbert	1915	1915		Fort Saskatchewan, Alta.

ACTIVE MEMBERS—*Continued.*

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Dozois, Leo Oswald Ross, Grad. R.M.C.	1913	1913	7 Thomas Blk., Calgary	Box 1774, Calgary, Alta.
Dumais, Paul T. C., Q.L.S.	1882	1907		Hull, P.Q.
Edwards, George, O.L.S.	1872	1909		Ponoka, Alta.
*Elliott, Lt. George Reginald, Grad. S.P.S.	1913	1913		Calgary, Alta.
Engler, Carl, B.A.	1905	1907	Topographical Surveys, Ottawa.	145 Powell Ave., Ottawa
*Evans, Lt. Stanley Livingstone, Grad. S.P.S.	1911	1912	Topographical Surveys, Ottawa.	Corinth, Ont.
*Ewan, Lt. Hedley Jenkins	1914	1915	Topographical Surveys, Ottawa.	Yarmouth, N.S.
Ewing, Ernest Olliphant, Grad. S.P.S.	1908	1914		Toronto, Ont.
Fairchild, Charles Courtland, O.L.S., A.L.S.	1901	1910		54 Brant Ave., Brantford, Ont.
Fawcett, Adam	1893	1907	Topographical Surveys, Ottawa.	Gravenhurst, Ont.
Fawcett, Thomas, D.T.S., O.L.S.	1876	1907	Boundary Surveys, Ottawa	7 Driveway W., Ottawa
Fawcett, Sydney Dawson	1911	1914	Topographical Surveys, Ottawa.	120 Belmont Ave., Ottawa
Finnie, Oswald Sterling, B.Sc.	1915	1915	M.L. & Y. Branch, Ottawa	353 Stewart St., Ottawa
*Ferguson, Capt. George Hendry, M.C., Grad. S.P.S.	1909	1910	Conservation Commission, Ottawa	
*Fletcher, Lt. James Allan, Grad. S.P.S.	1911	1911	Topographical Surveys, Ottawa.	Fletcher, Ont.
*Fletcher, Lt. William Arthur, Grad. S.P.S.	1912	1915	Topographical Surveys, Ottawa.	Thornton, Ont.
Fontaine, Louis Elie	1892	1907	Topographical Surveys, Ottawa.	Levis, P.Q.
Francis, John	1875	1907		Portage la Prairie, Man.
Galletly, James Simpson, Grad. S.P.S.	1911	1911		Oshawa, Ont.
*Garner, Lt.-Col. Albert Coleman, D.S.O. S.L.S.	1911	1909	Chief Surveyor, Land Titles Office, Regina, Sask.	Regina, Sask.
Gibbon, James, Grad. S.P.S., O.L.S.	1891	1908		1631 Collingwood St., Van.
Glover, Arthur Edward, Grad. S.P.S.	1911	1913	Topographical Surveys, Ottawa.	12432 Stony Plain Rd., Edmon.

ACTIVE MEMBERS—*Continued.*

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Gorman, Edwin Frederick	1915	1919	Topographical Surveys, Ottawa.	Buckingham, P.Q.
Gourlay, Robert Murray, O.L.S.	1914	1914	Topographical Surveys, Ottawa.	97 Spencer Ave., Toronto
Grassie, Charles Andrew, Grad. S.P.S.	1910	1913		Medicine Hat, Alta.
Griffin, Alfred Dyke, B.A., O.L.S.	1913	1913		Chatsworth, Ont.
*Grover, Major George Alexander, B.A., B.Sc.	1904	1907		Toronto
Hamilton, Charles Thomas, Grad. S.P.S.	1911	1913	1038 Standard Bank Bldg., Vancouver	
*Haggen, Rupert Williams, B.C.L.S.	1911	1911		Quesnel, B.C.
*Hardouin, Joseph	1914	1914	Topographical Surveys, Ottawa.	
Harris, John Walter, O.L.S., M.L.S., M.E.I.C.	1872	1913	Assessment Commissioner and City Surveyor, Winnipeg, Man.	Winnipeg, Man.
*Harvey, Lt. Charles, B.C.L.S.	1904	1910	Topographical Surveys, Ottawa.	Kelowna, B.C.
Hawkins, Albert Howard, B.C.L.S., B.A.Sc.	1906	1907	Topographical Surveys, Ottawa.	Ottawa
*Heathcott, Capt. Robert Vernon, P.A.S.I.	1907	1907	Militia Department	Ottawa
Henderson, Francis Dillon, Grad. S.P.S.	1906	1907	Topographical Surveys, Ottawa.	5 Woodlawn Ave., Ottawa
Herriot, George Henry, B.Sc.	1909	1911	Topographical Surveys, Ottawa.	2 Martello Apts., 625 Broadway Ave., Winnipeg, Man.
*Hobbs, Wilfred Ernest	1912	1912		East Kildonan, Man.
Hopkins, Marshall Willard, O.L.S.	1901	1907	Chief Surveyor, Land Titles Office, Edmonton, Alta.	
Hubbell, Major Ernest Wilson, Grad. R.M.C.	1884	1907	Chief Inspector of Surveys, Int. Dept., Ottawa	61 Russell Ave., Ottawa
*Inkster, Lt. Oluff	1911	1911	Topographical Surveys, Ottawa.	Edmonton, Alta.

ACTIVE MEMBERS—*Continued.*

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Jackson, John Edwin, Grad. S.P.S., O.L.S.	1911	1917	Topographical Surveys, Ottawa.	164 Cumberland Ave., Hamilton, Ont.
Jephson, Richard Jermy, O.L.S., B.C.L.S.	1880	1909		Box 986, Brandon, Man.
Johnston, Robert Henry, Grad. S.P.S.	1913	1913		10016-108th St., Edmon., Alta.
Johnston, William James, O.L.S., B.C.L.S.	1911	1911	Topographical Surveys, Ottawa.	1816 Waterloo Road, Van., B.C.
Johnston, James Homer	1912	1912		Peace River, Alta.
Joslyn, Cecil Earl, B.Sc.	1916	1919	Imperial Munitions Bd., Toronto	
King, Arthur Harry	1916	1918	Topographical Surveys, Ottawa.	Maitland, Hants, N.S.
King, John Albert Shirley, B.Sc., A.M.E.I.C.	1914	1915	Topographical Surveys, Ottawa.	18 Broadway Ave., Ottawa
Kitto, Franklin H.	1908	1911	Natural Resources Intelligence Branch, Int. Dept., Ottawa	36 Patterson Ave., Ottawa
Knight, Richard H., Grad. S.P.S., A.L.S.	1904	1907	Topographical Surveys, Ottawa.	10417-100th St., Edmon., Alta.
Lamarque, Ernest Charles, B.C.L.S.	1917	1918		Box 385, Anyox, B.C.
Lambart, Howard Frederick John, B.Sc.	1907	1917	Geodetic Survey, Ottawa	7 Rideau Gate, Ottawa
Latimer, Frank Herbert, B.C.L.S.	1885	1912		Penticton, B.C.
LeBlanc, Pierre Maxime Henri	1913	1913	Topographical Surveys, Ottawa.	170 Osgoode St., Ottawa
Lighthall, Abram, B.Sc., B.C.L.S.	1909	1911		2328 Vine St., Vancouver
*Logan, Robert Archibald	1914	1919		Middle Musquodoboit, N.S.
Lonergan, Gerald Joseph, Q.L.S., A.L.S.	1901	1907	Inspector of Surveys, Topographical Surveys, Ottawa	Buckingham, P.Q.
Lumb, William Ewart, B.Sc., O.L.S.	1914	1917	Topographical Surveys, Ottawa.	Bancroft, Ont.
Lumsden, Hugh D., C.E., O.L.S., M.I.C.E., M.E.I.C.	1872	1907		Orillia, Ont.
*Lyon, Lt. John Edward, Grad. R.M.C.	1917	1917		431 Cooper St., Ottawa
*Macdonald, Lt. Colin Stone	1914	1917	Topographical Surveys, Ottawa.	139 Stewart St., Ottawa, Ont.

ACTIVE MEMBERS—*Continued.*

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
MacIlquham, Walter Lloyd, B.Sc.	1913	1918	Topographical Surveys, Ottawa.	41 Grove Ave., Ottawa
MacTavish, William Higgins, Grad. S.P.S.	1913	1917	Geodetic Survey, Ottawa	66 Brighton Ave., Ottawa
Martindale, Ernest Smith, Grad. S.P.S.	1911	1912	Topographical Surveys, Ottawa.	Kingsmill, Ont.
Martyn, Oscar William, Grad. S.P.S., S.L.S.	1911	1912		Regina, Sask.
Matheson, Hugh, B.Sc., O.L.S.	1911	1911		Box 1524, Sudbury, Ont.
McArthur, James Joseph	1879	1909	International Boundary Commissioner, Ottawa	459 Gilmour St., Ottawa
McCaw, Robert Daniel, O.L.S., B.C.L.S.	1909	1912	35 Howe Street, Vancouver	
*McCloskey, Lt. Michael D'Arcy, M.M.	1915	1917	Topographical Surveys, Ottawa.	Chelsea, P.Q.
McElhanney, William George, B.C.L.S.	1911	1913	604 Board of Trade Bldg., Vancouver	Vancouver.
McElhanney, Thomas Andrew, Grad S.P.S.	1912	1919	Topographical Surveys, Ottawa.	
McEwen, Duncan Findlay, B.Sc., A.L.S.	1911	1912	Topographical Surveys, Ottawa.	Hensall, Ont.
McFarlane, John Baird, Grad. S.P.S.	1908	1910		Lake Saskatoon, Alta.
McGarry, Patrick Joseph, Grad. S.P.S.	1914	1917	Topographical Surveys, Ottawa.	Merritton, Ont.
McKay, Robert B., B.Sc., B.C.L.S.	1912	1912	Topographical Surveys, Ottawa.	1348 Haro St., Vancouver, B.C.
*McKnight, Lt. James Henry, Grad. S.P.S. O.L.S.	1913	1914	Topographical Surveys, Ottawa.	Simcoe, Ont.
McMillan, George, Grad. S.P.S., O.L.S., A.L.S.	1906	1907		Finch, Ont.
McNaughton, Alexander Lorne, Grad. S.P.S.	1905	1913		Cornwall, Ont.
*Meikle, Lt. McKay, B.Sc.	1916	1917		316 Daly Ave., Ottawa
*Melhuish, Paul, B.Sc., B.C.L.S.	1911	1912	Topographical Surveys, Ottawa.	Vancouver, B.C.
Miles, Charles Falconer	1872	1907		Calgary, Alta.
Milliken, John Bolton, B.A., B.Sc.	1912	1913	Topographical Surveys, Ottawa.	First Ave., Ottawa
Moberly, Harford Kenneth, Grad. S.P.S.	1903	1909		Yorkton, Sask.

ACTIVE MEMBERS—*Continued.*

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Montgomery, Royal Harp, Grad. S.P.S. S.L.S.	1905	1909	7 Thomas Blk., Calgary	Prince Albert, Sask.
*Moran, Lt. Patrick Joseph, B.Sc.	1914	1914	Topographical Surveys, Ottawa.	950 Jarvis St., Vancouver, B.C.
Morency, George Elie, Q.L.S.	1913	1914		162 Wellington St., Hull, P.Q.
Morrier, Joseph Eldedge, A.L.S., S.L.S.	1907	1909		Prince Albert, Sask.
Mountain, George A., O.L.S., Q.L.S., M.E.I.C.	1882	1907	Chief Engineer to the Railway Commission, Ottawa	336 MacLaren St., Ottawa
*Murdie, Capt. William Campbell, M.C., Grad. S.P.S.	1916	1917	Geodetic Survey, Ottawa	
Narraway, Athos Maxwell, B.Sc.	1911	1911	Controller of Surveys, Topographical Surveys, Ottawa	136 McLeod St., Ottawa
*Neelands, Capt. Abraham Rupert, M.C., Grad. S.P.S.	1912	1912		Hamiota, Man.
*Nelles, Major Douglas Henry	1907	1909	Boundary Surveys, Ottawa	
Neville, Everett A., O.L.S., Grad. S.P.S.	1911	1912		936 Granville St., Vancouver
Norrish, Wilbert Henry, B.Sc., O.L.S., A.L.S., A.M.E.I.C.	1914	1915	Topographical Surveys, Ottawa.	
Ogilvie, Noel J.	1905	1910	Superintendent of Geodetic Survey, Ottawa	574 MacLaren St., Ottawa
*Parry, Harry, B.E.	1912	1913	Topographical Surveys, Ottawa.	220 Lisgar Road, Ottawa.
*Palmer, Lt. Philip Ebenezer	1912	1912	Topographical Surveys, Ottawa.	St. John, N.B.
*Parsons, Lt.-Col. John Lindsay Rowlett, C.M.G., D.S.O., Croix-de-Guerre, Grad. S.P.S., O.L.S., S.L.S.	1905	1910		Regina, Sask.
Patterson, John Herbert	1918	1918	Topographical Surveys, Ottawa.	Kinosota, Man.
Patrick, Allan Poyntz, D.T.S., B.C.L.S.	1877	1910		Box 445 Calgary, Alta.

ACTIVE MEMBERS—*Continued.*

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Pearce, William, O.L.S., B.C.L.S.	1880	1910	Natural Resources, C.P.R.	Calgary, Alta.
*Pearson, Capt. Hugh Edward, M.C.	1912	1913		Edmonton, Alta.
Perron, Hermel Marie, B.A.	1914	1915		Edmonton, Alta.
*Perry, Lt. Alfred Melville	1917	1917	Topographical Surveys, Ottawa.	
Peters, Frederic Hatheway, Grad. R.M.C.	1910	1913	Commissioner of Irrigation, Calgary, Alta.	
Phillips, Edward Horace, Grad. S.P.S., S.L.S.	1902	1907	Land Titles Office, Regina, Sask.	Regina, Sask.
Phillips, Edwin Percy Argall, Grad. S.P.S., O.L.S.	1916	1918		Port Arthur, Ont.
Pierce, John Wesley, O.L.S.	1909	1911	Topographical Surveys, Ottawa.	Pembroke, Ont.
*Pinder, Major George Zouch, M.C.	1913	1914		Credit Foncier Bldg., Edmon.
Plunkett, Thomas Hartley, Grad. S.P.S.	1908	1911	Topographical Surveys, Ottawa.	Meaford, Ont.
Powell, William Hall, B.Sc., B.C.L.S.	1911	1912	City Engineer's Office, Vancouver	
Purser, Ralph Clinton, Grad. S.P.S.	1911	1911	Topographical Surveys, Ottawa.	211-5th Ave., Ottawa
Rainboth, George Louis, O.L.S.	1910	1911	Boundary Surveys, Ottawa	Aylmer, P.Q.
Rannie, John Leslie, B.A.Sc., D.T.S.	1909	1916	Geodetic Survey, Ottawa	198 Cartier St., Ottawa
Reid, John	1913	1913		161 Lenore St., Winnipeg
*Read, Lt. Hiram Earle, B.Sc.	1917	1919	Topographical Surveys, Ottawa.	233-12 Ave. N.E., Calgary, Alta.
Reilly, William Robinson, O.L.S., M.L.S.	1881	1907		Regina, Sask.
Rinfret, Claude, Q.L.S.	1908	1911	Topographical Surveys, Ottawa.	178 Russell Ave., Ottawa
Rice, Frederick William, B.Sc.	1908	1918	Topographical Surveys, Ottawa.	578 O'Connor St., Ottawa
*Rimmer, William Bolton, B.Sc., B.C.L.S.	1916	1918		Vancouver, B.C.
Roberts, Otto Beer, B.Sc.	1913	1915		Marengo, Sask.
*Robertson, Capt. Donald Fraser, Grad. S.P.S.	1909	1913	Indian Affairs Dept., Ottawa	Tracey Apts., Ottawa.
*Robinson, William Earl, Grad. S.P.S.	1914	1918	Topographical Surveys, Ottawa.	Oshawa, Ont.
*Rolfson, Lt. Orville, Grad. S.P.S., O.L.S.	1908	1909	Topographical Surveys, Ottawa.	Walkerville, Ont.

ACTIVE MEMBERS—*Continued.*

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Ross, George, B.A.Sc., O.L.S.	1882	1907		Welland, Ont.
*Ross, Capt. Joseph Edmund, O.L.S., B.C.L.S.	1891	1910		Kamloops, B.C.
Roy, George Peter	1881	1907		28 Lachevrotiere St., Quebec
Saint Cyr, Arthur	1887	1908		Montreal
Saint Cyr, Jean Baptiste	1887	1907		Montreal
*Saunders, Lt.-Col. Bryce J., B.A.Sc., O.L.S.	1884	1909		Edmonton, Alta.
*Scott, Walter Alexander, M.M., Grad. S.P.S.	1909	1910	Topographical Surveys, Ottawa.	Galt, Ont.
Seager, Edmund, O.L.S.	1872	1909		Kenora, Ont.
*Segré, Lt. Beresford Henry, Grad. S.P.S.	1912	1912		Toronto
*Seibert, Frederick Victor, Grad. S.P.S.	1911	1912	Topographical Surveys, Ottawa.	10741-126th St., Edmon., Alta.
Seymour, Horace Llewellyn, B.A.Sc., O.L.S., A.L.S., P.L.S.	1906	1910	Housing Committee of the Cabinet, Ottawa	Aylmer, P.Q.
Shanks, Thomas, B.A.Sc.	1902	1907	Asst. Surveyor-General, Topographical Surveys, Ottawa	Laurentian Club, Ottawa
Shaver, Peter Albert	1914	1914	Topographical Surveys, Ottawa.	Finch, Ont.
*Sheppard, Albert Campbell T., Grad. S.P.S.	1910	1912	Geological Survey, Ottawa	
*Shaw, Major Charles Æneas, O.L.S., B.C.L.S.	1880	1910		Greenwood, B.C.
*Sibbett, Lt. William Algernon, Grad. S.P.S., O.L.S.	1916	1918	Topographical Surveys, Ottawa.	Bracebridge, Ont.
Sirois, Joseph E.	1882	1912		Box 26, St. Anne de la Pocatiere, Kamouraska, P.Q.
Speight, Thomas Bailey, O.L.S.	1882	1907	703 Temple Bldg., Toronto	
Soars, Henry Martin Robinson,	1908	1912	Topographical Surveys, Ottawa.	11117-91st Ave., Edmon., Alta.

ACTIVE MEMBERS—*Continued.*

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Steele, Ira John, Grad. S.P.S., O.L.S	1908	1909		
*Stewart, Lt. Alexander George, B.Sc.	1910	1912	Dept. of Public Works, Alberta	Edmonton, Alta.
Stewart, Norman Charles, Grad. S.P.S., B.C.L.S.	1912	1912	Topographical Surveys, Ottawa.	Nelson, B.C.
Stewart, William Malcolm, Grad. S.P.S.	1907	1911		Saskatoon, Sask.
Stewart, Allan Douglas	1916	1917	Natural Resources Intelligence Br., Int. Dept., Ottawa	251 Clemow Ave., Ottawa
*Stock, Major James Joseph, M.C., Grad. S.P.S.	1910	1913		Ottawa, Ont.
Stuart, Alexander Graham, B.Sc.	1911	1911		Beavermouth, B.C.
Street, Paul Bishop	1910	1911		17 Spadina Road, Toronto
Tassie, Gilbert Culloden, B.C.L.S.	1917	1917		Vancouver, B.C.
*Taylor, William Emerson, Grad. S.P.S., O.L.S.	1910	1914		323 Glen Road, Toronto
Taggart, Charles Henry	1911	1911	Topographical Surveys, Ottawa.	Kamloops, B.C.
Teasdale, Charles Montgomery, Grad. S.P.S.	1906	1908		36 Churchill Ave., Toronto
Tipper, George Adrian, Grad. S.P.S.	1911	1913		196 Marlborough Ave., Brantford, Ont.
Tobey, Wilmot Maxwell, M.A., D.T.S.	1906	1912	Geodetic Survey, Ottawa	96 Second Ave., Ottawa
Tyrrell, James Williams, C.E., O.L.S.	1887	1907	7 Hughson St., S., Hamilton, Ont.	
Underwood, Joseph Edwin, Grad. S.P.S.	1911	1911	Ross Block, Saskatoon, Sask.	
Van Skiver, Leighton Adelbert	1913	1913		Demorestville, Ont.
Von Edeskuty, Joseph Otto	1913	1913		
*Waddell, Capt. William Henry, O.L.S.	1907	1913		Edmonton, Alta.

ACTIVE MEMBERS—*Continued.*

NAME	Date of Comm.	Date of Admission to Assoc'n	BUSINESS ADDRESS	HOME ADDRESS
Walker, Claude Melville, Grad. S.P.S.	1911	1911	Topographical Surveys, Ottawa.	Banff, Alta.
Wallace, James Nevin, B.A., B.E., O.L.S.	1900	1911	7 Thomas Blk., Calgary	Calgary, Alta.
Warrington, George Arthur, Grad. S.P.S., M.L.S.	1913	1914	Public Works, Winnipeg	
*Waugh, Bruce Wallace, Grad. S.P.S.	1912	1913	Topographical Surveys, Ottawa.	
Watt, George Herbert, Grad. S.P.S.	1902	1907	Topographical Surveys, Ottawa.	138 Queen St., Ottawa
Weeks, Abel Seneca, O.L.S.	1892	1907		9528-106th Ave., Edmonton
Whitcher, Arthur Henry	1872	1912		315 Frank St., Ottawa, Ont.
White, Walter Russell, Grad. S.P.S., O.L.S.	1910	1912	Indian Affairs Dept., Ottawa	205-5th Ave., Ottawa
*Whyte, Harold Eustace, B.Sc., B.C.L.S.	1912	1912		536 Linden Ave., Victoria
Wight, Edmund James	1915	1917	Topographical Surveys, Ottawa.	Woodroffe, Ont.
Wing, Daniel Oscar, Grad. S.P.S., B.C.L.S.	1917	1918	Topographical Surveys, Ottawa.	614 St. Joseph St., Lachine, P.Q.
Wright, Alfred Esten, Grad. R.M.C., B.C.L.S.	1912	1912		Prince Rupert, B.C.
Wright, James Goldwin		1918	Topographical Surveys, Ottawa.	Westboro, Ont.

Deceased Members

NAME.	DATE OF DEATH.
Bolton, L. E. S.	June 13, 1916. Killed in action.
Brady, J.	
Carthew, W. M.	June, 1916. Killed in action.
Earle, W. S.	April 2, 1916. Killed in action.
Edwards, Prof. W. M.	Nov. 19, 1918.
Gass, L. H.	April 8, 1917. Killed in action.
Gordon, M. L.	1917. Killed in action.
Green, W. T.	Nov. 1, 1909.
Hunter, A. E.	July 14, 1914. Drowned.
Holcroft, H. S.	1916. Died on active service.
Johnson, C. E.	Dec. 31, 1913.
King, Dr. W. F.	April 23, 1916.
Lemoine, C. E.	1917.
McFadden, M.	1918.
McLean, J. K.	May 25, 1913.
Mackie, F. H.	Dec. 23, 1912.
Ogilvie, W.	Nov. 13, 1912.
Ponton, A. W.	Jan. 21, 1915.
Ratz, W. F.	Feb. 6, 1909.
Rainboth, G. C.	Nov. 2, 1910.
Reid, J. L.	June 18, 1911.
Robinson, E. W.	Aug. 4, 1916. Drowned.
Roy, J. E.	Nov. 10, 1918.
Selby, H. W.	Aug. 23, 1910.
Stacey, A. G.	June 4, 1908.
Stitt, O. M., M.C.	Aug. 16, 1918. Killed in action.
Tremblay, A. J.	1918. Killed in action.
Young, R. E.	Oct. 24, 1911.